

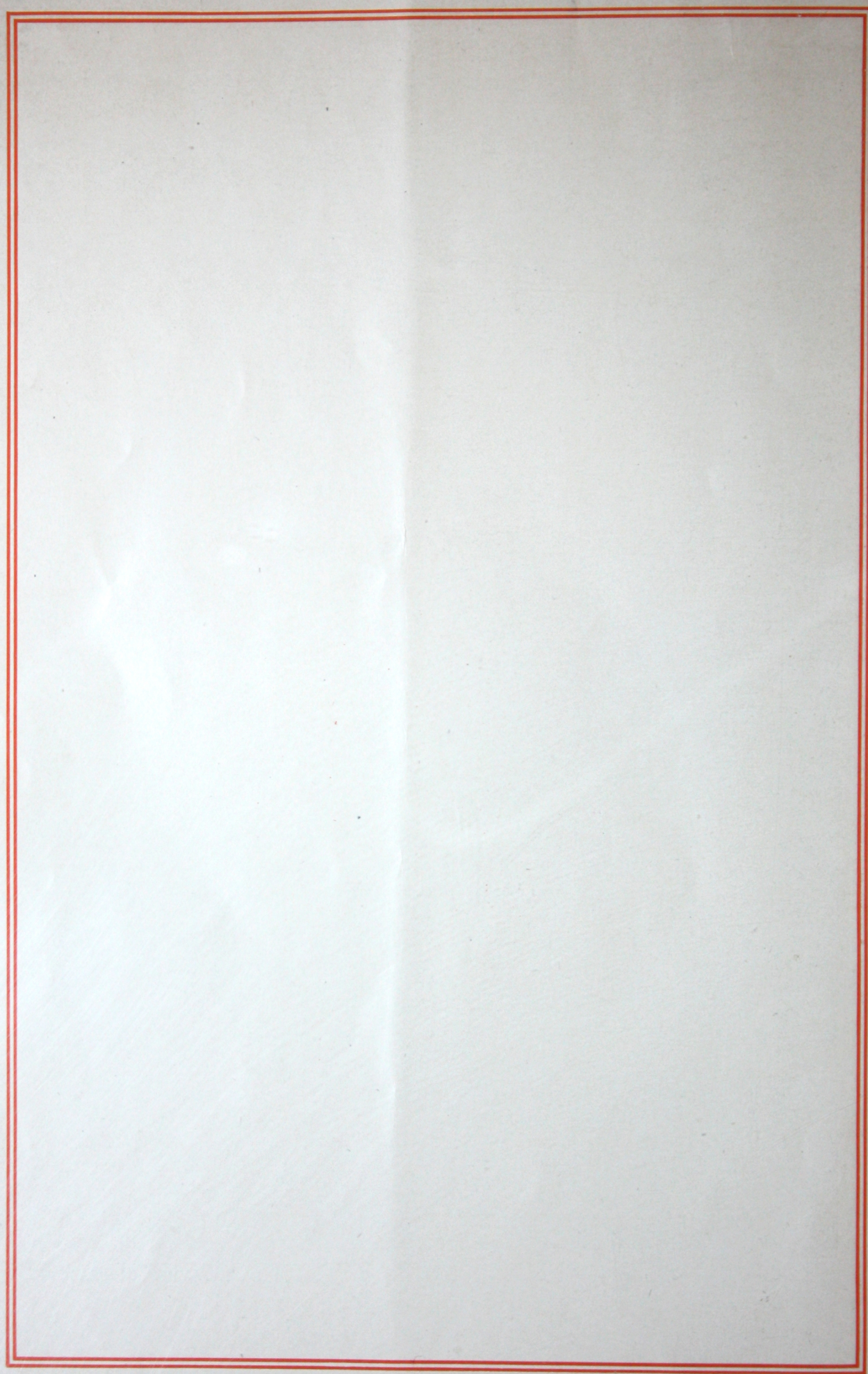
66.9

Seaboard Portland Cement Company

SCOTT, MITCHELL & CO., Bankers,
North American Building,
PHILADELPHIA, PA.
Fiscal Agents for
SEABOARD PORTLAND CEMENT CO.

2 Newport Portland
Cement Company

SCOTT, MITCHELL & CO., Bankers,
North American Building,
PHILADELPHIA, PA.
Fiscal Agents for
SEABOARD PORTLAND CEMENT CO.



SEABOARD
PORTLAND
CEMENT COMPANY
BOND OFFERING

THE PORTLAND CEMENT BUSINESS
NET EARNINGS—PROPERTIES AND
PROSPECTS—TECHNICAL REPORTS

SEABOARD PORTLAND CEMENT COMPANY
NEW YORK

GENERAL FINANCE COMPANY, FISCAL AGENTS
225 FIFTH AVENUE, NEW YORK

Seaboard Portland Cement Company

CATSKILL, NEW YORK, ON THE HUDSON RIVER

Offices, 225 Fifth Avenue, New York

OFFICERS

GEORGE A. BEATON	President
JOSEPH M. SHELLABARGER	Vice-President
WILL A. CHILDS	Vice-President
JOHN T. HOLMES	Secretary and Treasurer
GEORGE J. LOCKLEY	Auditor and Asst. Treasurer
HENRY E. BROWN	Chief Engineer
JAMES A. MACLAUCHLAN	Engineer

Plant, with capacity of 2,000,000 barrels a year, being constructed by

CEMENT ENGINEERING AND
CONSTRUCTION CO., New York

CARNEGIE TRUST COMPANY, New York
Trustees and Registrars

HARDY & SHELLABARGER, New York
Counsel

GENERAL FINANCE COMPANY, New York
Fiscal Agents

DIRECTORS

JAMES NICHOLS, Hartford, Conn.
President National Fire Insurance Company

WILL A. CHILDS, Calumet, Mich.
Asst. Superintendent Calumet and Hecla Mines

EDWIN THOMAS, Catasauqua, Pa.
President National Bank of Catasauqua

GEORGE A. BEATON, New York
President Seaboard Portland Cement Company

JOSEPH M. SHELLABARGER, New York
Hardy & Shellabarger, Attorneys

ISAAC F. WOODBURY, Boston
Woodbury and Leighton, Contractors and Builders

JOHN T. HOLMES, New York
Secretary and Treasurer Seaboard Portland Cement Company

DWIGHT C. REXFORD, Detroit, Mich.
Attorney, Director Wolverine Portland Cement Company

H. E. BROWN, B. S., Kingston, N. Y.
Cement Expert and Chief Engineer Seaboard Portland Cement Company

CHARLES P. COLLINS, Detroit, Mich.
Capitalist, Vice-President Central Savings Bank

Seaboard Portland Cement Company

Capital Stock, \$5,000,000

Bond Issue, \$2,000,000

Six Per Cent. Mortgage Twenty Year Gold Bonds

Dated July 1, 1907

Maturing July 1, 1927

Interest Payable July 1 and January 1

AT THE OFFICE OF THE

Carnegie Trust Company of New York

TRUSTEE AND REGISTRAR OF THE BONDS

Denominations, \$1,000, \$500, \$100

COUPON BONDS REGISTERED AS TO PRINCIPAL ONLY, OR PRINCIPAL
AND INTEREST, AND INTERCHANGEABLE

Subscriptions for Bonds and Remittances may be made to the
Seaboard Portland Cement Company, 225 Fifth Avenue, New York



Arranged and Printed at
The CHELTENHAM PRESS
New York

Seaboard Portland Cement Company's *Bond Offering*

THE Seaboard Portland Cement Company has been incorporated under the laws of the State of New York, to build and operate a Portland Cement mill, with an initial capacity of 2,000,000 barrels a year, on the Hudson River 100 miles north of New York City. The Company's property consists of over 700 acres, and has on it, in practically inexhaustible quantities, raw materials perfectly adapted for making Portland Cement in every respect equal to the best made in the world. The property has nearly one mile of frontage on the Hudson River with water rights and suitable location for docks, giving the Company the advantage of water transportation to New York City and other seaboard cities and towns—markets that can be depended upon to absorb a practically unlimited production.

The extent of the property; the quantity, quality, and availability of the raw materials; the exceptionally favorable location in relation to New York City, and water transportation to New York City and that vicinity and to all the seaboard cities and towns of the Atlantic coast combined, make it beyond question the most valuable Portland Cement property in this country.

The Seaboard Portland Cement Company, under a Trust Agreement between it and the Carnegie Trust Company of New York, Trustee, is authorized to issue \$2,000,000, 6 per cent. First Mortgage Twenty Year Gold Bonds to be used for acquiring the above property, building and equipping its plant, and furnishing working capital to start operations with.

These bonds are dated July 1, 1907, and mature July 1, 1927. Interest is payable July 1 and January 1, at the office of the Carnegie Trust Company of New York.

Among other provisions of the Bonds are the following:

Under its Trust Agreement with the Trustee all of the property of the Company, including its lands, buildings, machinery, and equipment, now owned or which it may hereafter acquire, are, and will be held to secure the holders of bonds until all bonds are paid and retired.

From and after the third year, a sinking fund must be created at the rate of at least \$100,000 per annum, to be held and disbursed by the Trustee for the retirement of bonds.

Bonds may be retired by lot at any time from and after the fifth year and up to the tenth year, at 105 per cent., and accrued interest; and at any time from the tenth year until maturity, at 102½ per cent. and accrued interest—three months' notice being required for the retirement of any bonds.

Principal and interest is payable in gold coin of the present standard of weight and fineness, at the office of the Carnegie Trust Company in New York City.

No dividends on stock can be paid in any year, unless accrued bond interest has been paid and sinking fund requirements met.

In any year, *after accrued interest on bonds has been paid and sinking fund requirements, including that year, have been paid or provided for*, dividends at the rate of six per cent. per annum may then be paid on the capital stock of the Company for such year. Dividends, however, in excess of six per cent. on stock issued and outstanding cannot be paid in any year until all the bonds have been retired.

NO other industry has ever experienced such rapid, and at the same time safe and conservative, growth and development as the manufacture of Portland Cement. No class of industrial investment has proved more uniformly safe and profitable than Portland Cement enterprises, where they have a property favorably located as to markets, ample suitable raw materials on their property, and the enterprise organized and operated on sound business lines.

The Seaboard Portland Cement Company has inexhaustible supplies of raw material, from which Portland Cement, equal in quality to any made in the world, can be manufactured. It has markets available for its product that will absorb practically unlimited quantities of Portland Cement, and which can all be reached by water transportation direct from the Company's mill. It has exceptionally favorable natural conditions and advantages in the location of its raw materials in relation to its factory and their availability. Under these conditions this Company will be able to manufacture and deliver Portland Cement not only for the New York market, but for all the more important markets of the Atlantic seaboard generally, at a minimum of 28 cents a barrel less, for manufacture and transportation combined, than it can be manufactured and delivered to these same markets for, from any other section in the world where Portland Cement is made.

With the selling price of Portland Cement in New York City and the other seaboard markets of that vicinity reduced to a point that would mean to the mills of any other section, including the Lehigh Valley, a substantial loss upon every barrel made and sold in the above described markets, this Company, even then, can earn sufficient to pay operating expenses, keep its plant in first class repair, pay annual interest and sinking fund requirements on its bonds, *and six per cent. dividends on its capital stock.*

Under these conditions the Company is in a position, to the extent of its production, to practically control the New York and other important Portland Cement markets of the Atlantic seaboard. With its natural, permanent advantages the Seaboard Company cannot fail to be an unusual commercial success, and easily develop into one of the most, if not the most, important and profitable Portland Cement enterprise in the United States.

Subscriptions are invited for the hereinabove described Bonds, which are herewith offered at par and accrued interest, accompanied by a like amount of the stock of the Company as a bonus, subject to change in the amount of stock bonus.

SEABOARD PORTLAND CEMENT COMPANY,
225 Fifth Avenue, New York.

SCOTT, MITCHELL & CO., Bankers,
North American Building,
PHILADELPHIA, PA.
Fiscal Agents for
SEABOARD PORTLAND CEMENT CO.

Portland Cement

PORTLAND CEMENT as a construction material today ranks in importance second only to steel, and is equally essential in the various lines of work in which it is used, in the development and progress of the country.

The demand for it is steadily increasing, and, notwithstanding that for several years new mills have been installed as suitable deposits of raw material have been discovered, and that mills already in operation have as a rule increased their output to their greatest possible capacity, the rate of increase in consumption has continuously exceeded the rate of increase in production.

The total of all the Portland Cement produced in the United States previous to 1880 was only 82,000 barrels. In 1880 the production in the United States for that year was 42,000 barrels. In 1886 it reached 150,000 barrels. In 1896 it had increased to 1,543,023 barrels per year. Ten years later, in 1906, the production in the United States was over 45,000,000 barrels, and a large increase in production over 1906 is assured for 1907.

While every effort has been made by manufacturers to meet the demand, the localities where deposits from which the best grade Portland Cement can be made are limited, and as these have to a very great extent been taken up the rate of increase in production cannot be long maintained. On the other hand, because of new uses continually being discovered for cement in building and construction work, for which it is better adapted than any other known material, and because of its steadily increasing use in already established lines, the rate of increase in demand and use is rapidly increasing and must continue to increase.

The prices which Portland Cement commands everywhere make the industry one of the most profitable in the world; and, without being in the hands of or controlled by a trust, prices have been maintained, and during the past two or three years have substantially increased, entirely as the result of a legitimate and ever-increasing demand. The most valuable and important market in the world for the product is the City of New York and vicinity, and because of its permanent character and the constantly increasing demand prices in this particular market should never be less than at present.

The Seaboard Portland Cement Company with its mill now being installed at Catskill, N. Y., on the Hudson River, with water transportation for its product will be able to manufacture and deliver Portland Cement to this market at less cost than it can be made and delivered for from any other section.

Seaboard Portland Cement Company

Markets—Advantages over Competitors—Cost of Manufacture—Net Earnings

AVITALLY important feature of any manufacturing enterprise is desirable markets, with cheap transportation for its product. The natural markets of the Seaboard Portland Cement Company include every city and town in the United States and Canada on the Atlantic seaboard and the Gulf of Mexico, and all the seaboard towns of Mexico, Central America, South America, and the West Indies, all of which can be reached by it by water transportation direct from its plant.

THE Seaboard Company's principal market will naturally be New York City and that vicinity, and with water transportation and other natural advantages, the Company will be able to manufacture and deliver Portland Cement for this market at a lower cost than it can be manufactured and delivered for from any other locality in the United States where Portland Cement is made.

Nowhere in the world is there so great a demand for Portland Cement as in New York City and its immediate vicinity, where there are now in progress improvements on a gigantic scale, before which all other engineering projects and undertakings of the world, past and present, pale in comparison. The great public and semi-public engineering projects and improvements now under way and authorized in and around New York, all of which must be carried out as rapidly as possible to meet the requirements of increasing population, total approximately, \$1,250,000,000. In every dollar's worth of this work, exceeding in extent and importance anything in improvements and engineering operations ever undertaken in the world, Portland Cement is an absolutely essential requisite, and enormous quantities must be used.

Other vast engineering projects already contemplated and which must be got under way even before the foregoing work is complete, will carry this work of building and rebuilding New York on for decade after decade. Every twenty

years, at the present rate of increase in population, New York must be practically rebuilt, and in all of this, Portland Cement is and must continue to be one, if not the most important, material to be used.

All of the gigantic building operations and engineering projects in and around New York are absolutely necessary to the life of the metropolis, and what is now being done must in a few years not only be renewed, but increased. The construction work and building involved in providing for the enormous population centered in and around New York, and its rapid increase, must go on uninterruptedly despite the condition of times and despite industrial conditions here and elsewhere. Greater New York grows and will continue to grow, in good years or bad years, at an ever-increasing rate. The ratio of this increase in 1903 was 3.7% per annum. In 1907 it has reached over 5%, and the annual increase in percentage of growth is such that doubling the population may be expected within fifteen rather than twenty years. Whether the population reaches 8,000,000 in 1922 or in 1927 matters little; one thing is sure—the increase in population is and will be enormous, and will continue. To take care of this increasing population necessitates carrying out the projects now under way and authorized, rapidly and uninterruptedly, and even before they are complete, the further increasing and extending of tunnels, subways, bridges, harbor improvements, aqueducts, sky-scrapers, apartment houses, railway terminals, and similar improvements.

The tunnels under the Hudson and East Rivers, in the building of which there is now being expended over \$200,000,000, are almost entirely of concrete and steel.

The bridges being built, and others assured (including the great \$75,000,000 Hudson River bridge) will cost as much and will require almost untold tons of cement in their foundations and anchorages.

Markets and Transportation.

New York Market not Affected by Industrial Conditions, Times, etc.

Tunnels, Bridges, Subways, etc., must all be Increased and Extended.

New York Most Important Cement Market in the World.

The vast railway terminal stations, and the magnificent sky-scrapers, some of them nearly 700 feet high, are all using and must use enormous quantities of Portland Cement.

Additional subways, of which five more are now building (and the Rapid Transit Commission is committed to build seventeen more), will require literally hundreds of miles of concrete floor and retaining walls, all built with Portland Cement.

Greater New York's new water supply, which will be brought from the Catskills, involves the construction of an eighty-five mile aqueduct of concrete, seventeen feet inside diameter and an outlay of over \$160,000,000, is already authorized.

Hundreds of millions of dollars are being and will be put into new factories, office buildings, apartment and flat houses in New York, Brooklyn, and suburbs, where building of this character must go on unchecked.

The foregoing conditions will make the district made up of New York City and that vicinity, for years to come, the largest users of Portland Cement in the United States. Because of this New York is and will continue to be the most important Portland Cement market in the world.

IN addition to the foregoing markets, that can be reached by water transportation, situated as the Company's property is, with the New York Central Railway lines running directly through it, the inland cities of New York State and New England can be reached rail by the Seaboard Company as advantageously as from any other cement plant in the East, and most of them at a much lower freight rate.

This is especially true of interior New England towns; exceptionally desirable markets, in a section that has the densest population and the most money per square mile of any part of the United States, outside of Greater New York.

The Company will take full advantage, however, of the opportunity to transport its product by water, instead of rail, and will use rail transportation only where better prices and larger net profits are assured from selling its product in the inland towns and cities.

NEW YORK CITY and that vicinity however, will always be the Seaboard Company's natural market.

The supply for this market now comes principally from the Lehigh Valley in Pennsylvania,

being transported entirely by rail. The requirements for Portland Cement in New York and vicinity are so much in excess of the ability of available districts to produce it that they must always depend largely on the Lehigh Valley mills.

**Advantages
in New York
Market.**

The price that users in and around New York will have to pay for Portland Cement will, therefore, be determined by the price at which the Lehigh Valley product can be profitably made and delivered. Most of the Lehigh Valley mills are compelled to bring limestone from other localities, in some instances a considerable distance, adding materially to the cost of manufacture. Taking every possible feature into consideration the average cost of manufacture in the Lehigh District is not less than sixty cents a barrel.

To reach the markets of New York and that vicinity they must ship their product by rail, the freight charge for which to New York is twenty-eight cents per barrel.

Under these conditions, Portland Cement cannot be manufactured in the Lehigh Valley, and delivered in New York, at an average cost of less than eighty-eight cents a barrel.

With all of its raw materials well located on the property where its plant will be situated, and all most conveniently located in relation to the Company's mill; with a modern, up-to-date mill, in which will be installed every improvement in equipment and machinery to reduce the cost of manufacture to the lowest point possible; and, **with water transportation, the Seaboard Portland Cement Company will be able to make and deliver Portland Cement in New York and to other points in that vicinity at a total cost of not over sixty cents a barrel.**

WITH Portland Cement selling in New York at a price representing only actual cost of manufacture and transportation for the Lehigh Valley companies, and with an initial capacity of 2,000,000 barrels a year, the Seaboard Company can earn annually over \$500,000 in profits. If, however, the prevailing market price is sufficient to cover not only the actual cost of manufacture and transportation, but a fair minimum profit for the Lehigh Valley mills, the *minimum* price which the Seaboard Company will have to meet will never be less than \$1.25 per barrel.

At \$1.25 per barrel its annual profits will be at least \$1,200,000.

At present market prices it will be over \$1,600,000.

**Markets
Reached Ad-
vantageously
by Rail.**

Cost of Manufacture, Net Earning and Results

THE only advantage that the Lehigh Valley mills have over the Seaboard Company is in the price of coal, the freight rate being 15 cents a ton less for them than the Seaboard Company. This, when reduced to the production of a barrel of Cement, however, amounts to less than .0075 cent a barrel.

Most of the Lehigh Valley mills, however, are compelled to bring their limestone, or a large part of it, in from a distance, and most of the mills are not modern and up to date, but have been in operation for several years and have been remodelled, added to, etc. Taking all the conditions as a basis, an absolutely safe figure for the minimum average cost of production for the Lehigh Valley mills is 60 cents a barrel, and in most cases it exceeds that amount.

As against the foregoing, the Seaboard Company has all of its clay and limestone on its own property, with both ideally located for getting them into the mill at a minimum cost. In addition, when completed, its mill will be the most thoroughly modern, up to date, and complete Portland Cement plant ever installed in this or any other country.

The following estimate for cost of manufacture per barrel for the Seaboard Company (made by Mr. H. E. Brown, Chief Engineer of the Company), which is based on known and fixed charges, and actual experience in the operation of Portland Cement mills, loaded sufficiently to make it safe in any emergency, has been confirmed by authorities of such standing and experience in the Portland Cement industry that there can be no possible question as to its being entirely safe and conservative. Those in charge of the installation of the Company's plant, and who will be in charge of its operations, as well as others familiar with conditions and in position to know, fully expect that the actual cost of production for the Seaboard Company will not exceed 50 cents a barrel.

The advantage of the Seaboard Company over the mills of the Lehigh Valley, as shown by the following, is 28.2 cents a barrel:

	Cents
Average Cost of Manufacture, per barrel, Lehigh Valley mills.....	60.0
Cost of Manufacture, per barrel, Seaboard Portland Cement Company,	
Coal for burning.....	12.0
Power.....	10.3
Labor.....	13.5
Administration	02.5
Insurance and Taxes.....	00.5
Repairs.....	05.0
Depreciation	05.0
Miscellaneous, including getting out and handling raw materials, etc., etc.....	05.0
	<u>53.8</u>
Seaboard Company's advantage in cost of manufacture.....	06.2
Minimum fixed and permanent advantage of Seaboard Company in freight charge, because of water transportation for its product.....	<u>22.0</u>
Safe minimum advantage of Seaboard Company as compared with Lehigh Valley mills.....	28.2
With 2,000,000 barrels annual capacity, this advantage gives the Seaboard Company (while selling its product at a price that would leave no profit whatever for the mills of the Lehigh Valley district) a net profit of....	\$564,000
The maximum interest charge on the Seaboard Company's Bonds, in any year (which will decrease as Bonds are retired), is.....	\$120,000
Annual Sinking Fund requirement.....	100,000
Six per cent. dividends on the Company's capital stock	<u>300,000</u>
Surplus.....	<u>520,000</u>
	<u>\$44,000</u>

At the present actual selling price for Portland Cement, the Seaboard Company would receive \$1.35 a barrel, net, at the mills, or a net profit of 81 cents a barrel. Upon this basis,

with three years of operation, the Company can pay 6 per cent. interest on its Bonds and 6 per cent. dividends on its capital stock annually; and, by the end of such *three* year period have retired its entire Bond issue at 105, and increased the capacity of its plant from 2,000,000 to 4,000,000 barrels a year.

One Year's Operation		Three Years' Operation	
Annual net earnings 2,000,000 barrels at 81 cents profit, per barrel.....	\$1,620,000	Net earnings, 3 years, at \$1,620,000 per year.....	\$4,860,000
Maximum annual interest....	\$120,000	Four years' interest (including construction year) at \$120,000 per annum, <i>maximum</i> annual charge.....	\$480,000
Annual sinking fund deposit	100,000	Three years' dividends at 6 per cent., or \$300,000 per annum.....	900,000
Six per cent. on capital stock	300,000	Retirement of \$2,000,000 bonds at 105.....	2,100,000
Annual surplus for increasing capacity of plant and adding to Sinking Fund.....	1,100,000	For surplus and increasing capacity to 4,000,000 bbls. a year.....	\$1,380,000
	\$1,620,000		

At \$1.25 per barrel, delivered in New York City (cost of manufacture and transportation for the Seaboard Company, 60 cents a barrel), the Company will have a net profit of 65 cents a barrel. With this, in *four* years of operation, the Seaboard Company can pay 6 per cent. interest on its Bonds and 6 per cent. dividends on its capital stock annually; and, by the end of such *four* year period have retired its entire Bond issue at 105, and increased the capacity of its plant from 2,000,000 to 4,000,000 barrels a year.

One Year's Operation		Four Years' Operation	
Annual net earnings, 2,000,000 bbls. at 65 cents per bbl.....	\$1,300,000	Net earnings, 4 years, at \$1,300,000 per year.....	\$5,200,000
Maximum annual interest....	\$120,000	Interest, 5 years (including construction year) at \$120,000 per annum, <i>maximum</i> annual charge.....	\$600,000
Annual sinking fund deposit.	100,000	Four years' dividends at 6 per cent., or \$300,000 per year.....	1,200,000
Six per cent. on capital stock.	300,000	Retirement of \$2,000,000 bonds at 105.....	2,100,000
Annual surplus for increasing capacity of plant and adding to sinking fund.....	780,000	Surplus for increasing capacity to 4,000,000 bbls. a year	\$1,300,000
	\$1,300,000		

At \$1.00 per barrel, delivered in New York City (cost of manufacture and transportation for the Seaboard Company, 60 cents a barrel), the Company will have a profit of 40 cents a barrel. With this, in *ten* years of operation, the Company can pay 6 per cent. interest on outstanding Bonds and 6 per cent. dividends on its capital stock annually; and, by the end of such *ten* year period, have retired its entire Bond issue at 105, and increased the capacity of its plant from 2,000,000 to 5,000,000 barrels a year.

One Year's Operation		Ten Years' Operation	
Annual net earnings, 2,000,000 bbls., at 40 cents per bbl.....	\$800,000	Net earnings, 10 years, at \$800,000 per year.....	\$8,000,000
Maximum annual interest....	\$120,000	Interest for 11 years (retiring \$100,000 of bonds at 105 each year after the first or construction year.....	\$964,000
Annual sinking fund deposit..	100,000	Ten years' dividends at \$300,000 a year.....	3,000,000
Six per cent. on capital stock	300,000	Retirement of bonds at 105...	2,100,000
Annual surplus for increasing capacity of plant and adding to sinking fund.....	280,000	For surplus and increasing the capacity of the plant to 5,000,000 bbls. a year.....	\$1,936,000
	\$800,000		

To pay interest annually and retire the Bonds, within the period provided in the Mortgage and Bonds, 20 years, with the Company's initial capacity of 2,000,000 barrels, will require a profit of less than 10 cents a barrel for this period. To earn this would require a selling price for the Seaboard Company's product, *delivered in New York City*, of not to exceed 70 cents a barrel, *which is equivalent to a selling price of 42 cents a barrel, at the mills, for Lehigh Valley Cement.*

To pay (in addition to interest and retirement charges on the Bond issue) 6 per cent. annual dividends on the Company's capital stock, will require, with the initial capacity of its plant, an additional profit of 15 cents a barrel. Therefore, the selling price (based on New York delivery) necessary to enable the Seaboard Company to pay interest and retirement charges on its Bonds, in accordance with the terms thereof, and 6 per cent. annual dividends on its capital stock, is **85 cents a barrel**, which is equivalent to a selling price of 57 cents a barrel, *at the mills*, for Lehigh Valley Cement.

The lower selling prices in the foregoing are not used because it is believed that there is any possibility of prices being that low, but merely to show that with water transportation, and its natural advantages in the character and location of raw materials, the Seaboard Company can, even at such prices, *from earnings*, pay operating expenses, including proper maintenance of its plant, and *from net earnings* meet interest and sinking fund requirements on its Bonds, and at least 6 per cent. on its capital stock, making its position in competition impregnable.

Properties, Raw Materials and General Advantages.

THE property of the Seaboard Portland Cement Co. is situated at Catskill, on the Hudson River, 100 miles north of New York City, and consists of over 700 acres. The raw materials found on the property consist of lime rock, clay, and shale. While Portland Cement is made from other similar materials, containing practically the same ingredients, it is a well-known and established fact that the highest grade and best Portland Cement possible to make (that which can stand the most severe tests and consequently command the highest price), is produced from the particular kinds of raw materials found on this Company's property. It has been fully and completely demonstrated that Portland Cement, equal in every respect to the best made in the world, can be made from the materials found on this property, extensive tests and analyses made by a number of engineers and experts in separate and independent investigations having proved that these materials are perfectly adapted for Portland Cement.

Raw Material
and Quality
of Cement
that can be
Made.

Cement Made
from Same
Material has
Stood Every
Test.

The materials found on the Seaboard Portland Cement Company's property are identical with those found on the properties of three other companies which have for the past few years been operating mills on properties adjacent to this property. The cement made by these mills has been introduced into some of the most important work in New York City, the more important

cities and towns of New England, and in general sea work, including the Panama Canal, and in all cases it has stood every test and has been indorsed as being equal to any cement that can be obtained anywhere.

While the raw materials found on the properties of all these companies are identically the same, the property of the Seaboard Company is much more extensive and the quantity of the raw materials found on the property is vastly greater than on the other properties.

One of these companies whose property adjoins the Seaboard Company's properties is the Alsen Company, who have for the past six years been manufacturing Portland Cement from the materials on their property.

Experience
with Port-
land Cement
made from
Same Ma-
terials.

The Alsen Company have for many years been large manufacturers of Portland Cement in Germany, and their brand of cement is conceded by the trade to be one of the best in the world. In a printed statement they say that there is no mystery or secret in their ability to make the exceptionally high grade of Portland Cement which they do at their plant on the Hudson River, but that it is simply a matter of *perfect material*, care, and system.

Neither the Alsen Company nor any other company has any secret or patented process for making Portland Cement, or any superior knowledge of the fundamental principles of producing it, whereby they have advantage over their competitors. Using identically the same materials; subjecting them to the same processes and treatment

Cement to be
Made Equal
to any in the
World.

that the Alsen Company do; operating a thoroughly equipped, modern, up-to-date mill, under the direction of experienced Portland Cement makers, it is apparent that the Seaboard Portland Cement Company can produce cement equal in every respect to the Alsen product, which is to-day conceded to be equal to any made in the world.

In explanation of their selecting this property on the Hudson River, the Alsen Company makes the following statement:

"The Alsen engineers spent three years searching all sections for a better raw deposit than had yet been discovered, rejecting after careful tests properties that did suit less critical manufacturers.

"When the purchase of this property (their Hudson River property) was under consideration, this company already owned one of the best cement properties in the State of Pennsylvania, but the exhaustive tests of the limestone and clay by our chemists, and by other well-known experts consulted, so conclusively demonstrated the superiority of our particular Hudson River deposits over the raw material found in Pennsylvania that we abandoned further thought of making Portland Cement on our Pennsylvania property."

Hudson River
Materials
Better than
those of Le-
high Valley.

Actual experience in the use of the Portland Cement manufactured in the mills of the companies operating with identically the same materials as those found on the Seaboard Company's property, has proved, beyond possible question, that this Company can produce a Portland Cement that will stand the most severe tests ex-

Cement
will meet
Most Severe
Require-
ments.

acted for use in sea water and reinforced concrete construction. In a recent competition for supplying 300,000 barrels of cement for the extension of the Florida East Coast Railway, over the Florida Keys, from Miami to Key West, the Alsen Company's product from their Hudson River mill was the only cement which met the specifications in every particular, and the contract was awarded for this cement, notwithstanding the fact that the bid for supplying it called for a price approximately 15 cents a barrel higher than the next lowest bidder. In a special Panama Canal contract, requiring unusually severe tests, this same cement, made from identically the same materials to be used by the Seaboard Company, was the only American cement that passed the test, not one barrel of it being rejected.

Its ability to produce a cement of this quality will enable the Company to meet every possible requirement and test in all classes of seawater work generally, and for all work in seaboard cities and towns, where concrete must withstand the more severe elements and for which work cement that can stand the required tests commands the highest prices paid anywhere.

The construction and equipment of the Company's mill will be carried on as rapidly as conditions will permit, and the production of cement will be begun as early as possible—not later than July, 1908.

While the general understanding is that the initial capacity of the Company's mill is to be 5,000 barrels a day, it will actually have a capacity of 2,000,000 barrels per annum, and this capacity will be increased to 4,000,000 barrels a year within the next four or five years.

Ultimate
Capacity to
be 10,000 Bar-
rels a Day.

In the installation of its plant, the Company will profit by the extensive experience of other companies, and in its construction and equipment the co-operation and supervision of experts, interested in the enterprise, who have been eminently successful in building and installing other Portland Cement mills. In building and equipping its plant, the Company will take advantage of every improvement that has been demonstrated to be of value in reducing the cost of manufacture, and install a plant that can be operated with the greatest possible economy, and in all respects be the best mill yet built in this or any other country.

Company to
have Best
Cement Mill
ever Built.

UNLIKE many other Portland Cement enterprises, especially those in the Lehigh Valley, which are compelled to obtain limestone from other localities and haul it by rail into their plants, all of the raw materials to be used are found on the property of the Seaboard Portland Cement Company adjacent to its mill.

All Raw
Material on
its Own
Property.

LIMESTONE constitutes over two-thirds of the raw material used. This is found on the Seaboard Company's property in ledges outcropping approximately 100 to 200 feet above the mill site, over one mile in length, all on the Company's property.

To the east of these limestone ledges there is an inexhaustible supply of clay, which, combined with the limestone, makes as perfect a combination for

Perfect Com-
bination of
Raw
Materials.

manufacturing Portland Cement as has ever been found anywhere in the world.

An engineer and cement expert who has recently examined and is thoroughly familiar with the property has made an estimate of the quantity of lime rock and clay. The clay supply is practically inexhaustible, and of the limestone he stated that, if it is quarried to a depth of but 100 feet, it would give material enough to make, annually, 4,000,000 barrels of cement for nearly a hundred years.

SITUATED as it is, the limestone can be conveyed from the quarries into the factory by gravity for not to exceed two cents per ton. The clay to be used in combination with the limestone is so situated that it can be easily and cheaply delivered to the factory. Under the conditions existing at this property, there is not a Portland Cement plant operating anywhere that can get its raw materials into the mill at a lower expense than it can be done here.

WHILE the property is situated a sufficient distance from New York City to insure low cost of living, it is still near enough that the Company will be able

to draw upon the enormous surplus of labor constantly available, due to immigration.

COAL for fuel can be obtained by rail at as low cost as other plants in the East, and the Company will be on an equal footing in this respect with any other plant located in the Eastern part of the United States.

THIS Company will obtain its water from the Hudson River and will always have ample supply for all purposes connected with its operation.

IN certain other localities, for various reasons, plants are frequently unable to continue their operations throughout the entire year. This is especially true where marl, instead of limestone, is used, and such companies as a rule are compelled to shut down during a considerable portion of the year when their marl beds are frozen and raw materials cannot be obtained. Under conditions existing on the Hudson River there is nothing whatever to prevent the Seaboard Company's mill from operating continuously throughout the entire year, an advantage as obvious as it is important.

Convenience
of Raw Ma-
terial.

Fuel Supply

Ample Sup-
ply of Water.

Continuous
Operation.

Labor
Abundant.

*Editor of the "Chemical Engineer,"
Author of "Portland Cement"
and "The Chemist's Pocket Manual."*

*Expert on the manufacture,
testing and analysis of
Portland Cement.*

Richard K. Meade,

*Chemical Engineer,
Analytical and Consulting Chemist.*

NAZARETH, PA., May 6, 1907.

SEABOARD PORTLAND CEMENT COMPANY,
NEW YORK.

Gentlemen:

At your request I visited your property situated in Greene County, N. Y., along the Hudson River, at Dewitt Point. I spent sufficient time on the ground to go over practically all of it, in company with Mr. Brown, sampling the rock in upwards of twenty-five places. A large amount of limestone is exposed on the property, and from the analyses which I made of samples taken from these exposures, I should say that you have here a supply of limestone sufficient to last a large cement plant many years. The quality of this rock is excellent as the eight analyses following will show. The first four samples are taken from the lower beds of the formation and represent the Pentamerous and Tentaculite limestones, while the last four samples are taken from the Becraft limestone which will prove the main source of calcareous material for your mill. The last four samples were taken some distance apart and represent a considerable area.

Analyses of Limestone Samples.

	Silica.	Oxide of Iron and Alumina.	Carbonate of Lime.	Carbonate of Magnesia.	Sulphur Trioxide.
No. 1.....	31.68	1.44	62.09	2.94	0.20
No. 2.....	5.22	1.80	88.26	3.65	
No. 3.....	8.04	2.20	82.31	1.12	
No. 4.....	19.70	1.28	78.34	0.95	
No. 5.....	5.24	0.88	92.33	0.95	
No. 6.....	5.64	1.38	91.15	1.12	
No. 7.....	0.96	0.82	97.65	0.64	0.15
No. 8.....	2.08	0.96	95.85	1.01	

Other samples taken from the outcrop of the Becraft limestone on this property, upon which only determinations for lime were made, gave the following results:

No. 9.....	96.51	per cent carbonate of lime
No. 10.....	95.80	" " "
No. 11.....	96.10	" " "
No. 12.....	94.48	" " "
No. 13.....	94.53	" " "
No. 14.....	97.82	" " "
No. 15.....	97.06	" " "
No. 16.....	96.18	" " "

All the limestone samples were low in magnesium carbonate; those from the upper beds unusually so.

I also took samples of the clay which lies in vast beds on the river terraces to the east of the railroad track. The analyses given below show this clay to be of very uniform composition, and inspection shows it to be free from coarse sand or fine pebbles, a very important quality for clays to be used for Portland Cement manufacture. Sample No. 2 was taken on top of a large hill about the middle of the clay deposits and sample No. 1 was taken from the foot of this hill. Sample No. 3 was taken about a quarter of a mile away, at the foot of Dewitt Point, on the river bank, where the water had exposed it.

Analyses of Clay Samples.

	Silica.	Oxide of Iron.	Alumina.	Lime.	Magnesia.	Sulphur Trioxide.
No. 1.....	52.14	6.90	18.00	3.79	2.52	0.38
No. 2.....	55.42	7.85	20.15	2.63	3.19	0.40
No. 3.....	52.58	7.60	19.54	3.44	2.98	0.43

I think it would be hard to find a more uniform clay than the analyses show this to be. It is of excellent composition for use with the limestones sampled, since cement of almost any composition desired can be manufactured, by using a certain proportion of the Pentamerous limestone along with the Becraft. If a cement high in silica and low in alumina is desired, a large percentage of the highly silicious Pentamerous limestone is used, while if a high alumina cement is desired, only the purer Becraft limestone should be used. The ability to accurately and conveniently control the ratio of silica to alumina in cement is a great advantage, as it will be much easier, if this can be done, to make a cement of uniform strength and setting time.

In conclusion, I should say that you have an almost inexhaustible supply of limestone and clay, which can be readily and economically brought to either of the sites which you now are considering for your mill, by means of a bucket cableway. That this clay can be dug from a hillside in such a way as to contain a minimum of water for this class of material and that the limestone is certainly of no more than average hardness. The chemical composition of the raw materials leaves nothing to be desired, and provided proper mechanical appliances are placed in your mill and the process of manufacture is properly supervised, it is my opinion that you should be able to make cement of the very highest grade.

Yours very truly,

(Signed) RICHARD K. MEADE.

H. E. Brown, B.S.

Chemical Engineer and Cement Expert.

NEW YORK, May 9, 1907.

SEABOARD PORTLAND CEMENT COMPANY,
NEW YORK.

Gentlemen:

I have made a careful study of your property on the Hudson River, located four miles south of Catskill, New York, and submit the following report:—

Location and General Description

The property lies 105 miles north of New York City on the Hudson River and has a frontage on the river of about three-quarters of a mile, with excellent natural dockage facilities. Approximately one-third of the total acreage consists of clay terraces which rise above the river from 30 to 100 feet. These clay terraces have been eroded by the wash of waters seeking the river until they are now irregular shaped hills.

West of the clay terraces, the lime rocks have been tilted and lifted into a variety of inclined positions. The general trend of them is nearly parallel with the river, presenting the appearance of a bold irregular shaped ridge rising from 150 to 200 feet above the clay terraces.

Quality of Materials

The lime rocks are highly fossiliferous and crystalline, carrying a calcium carbonate content of 70 to 97 per cent.

A great number of analyses have been made, all of which show uniformity for each of the characteristic strata.

A few of these analyses are given as illustrations of the strata to be used:

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Calcium carbonate.....	95.10	97.25	96.89	97.76	93.60	85.04	75.18	78.75
Magnesium carbonate.....	Trace	Trace	Trace	Trace	1.56	1.62	Trace	Trace
Silica.....	3.46	2.20	3.26	1.66	4.52	7.18	23.90	16.84
Aluminum oxide.....	.72	1.58	1.48	.40	.78	3.46	1.32	3.42
Ferric oxide.....								

The most abundant rock known as the Becraft limestone runs as shown in analyses I. to IV. inclusive. Next in quantity comes the Pentamerous. Analyses VII. and VIII. are averages of this stratum. Analyses V. and VI. are characteristic of the Tentaculite limestone, of which there is less than of the Pentamerous. An estimate of the relative quantities shows that there is about twice as much of the Becraft as of the other two strata combined.

An average limestone analysis made from the entire field would run about as follows:

Calcium carbonate.....	90.0% to 94.0%
Magnesium carbonate.....	.5% to 1.5%
Silica	4.0% to 7.0%
Aluminum oxide }	1.0% to 2.0%
Ferric oxide }	

The composite limestone made from a mixture of the three strata is most excellently adapted for combination with the clays to form a high grade Portland Cement. All of the hill district on the property lying to the east of the West Shore R. R. consists of solid clay banks. The usable clay begins a few inches beneath the surface of the terraces and extends far below the level of the Hudson River.

Two apparently different varieties of the clays occur—the yellow and the blue, the first lying on top. Analyses of these clays made from samples taken both vertically and horizontally from the deposits show them to be exceptionally uniform, of a fine texture, free from nodules, sand and grit, and on account of the finely divided, uniformly distributed calcium carbonate, which it contains, should break up and dry more easily than the clays which are used by most Portland Cement factories using limestone and clay.

The analyses of average samples of the clays are.

	<i>Yellow</i>	<i>Blue</i>
Silica	54.24	55.62
Aluminum oxide	16.85	17.36
Ferric oxide	8.20	7.94
Calcium oxide.....	3.30	4.60
Magnesium oxide	2.00	1.75
Sulphur trioxide	.69	.65
Loss on ignition.....	8.98	8.04
Alkalies	(not determined)	

The above analyses show these clays to be excellently adapted for combination with the lime rocks to make a high grade Portland Cement.

From examinations made in quarries near to your property, on the Becraft limestone, it is evident that there is also a large shale deposit which comes in alongside of the limestones, but on your property has not been identified as a surface showing. From a study of the outcrops it is safe to say that at depths of from 75 to 100 feet an abundance of this black slaty shale occurs on your holdings in immediate proximity to the Becraft limestone.

An analysis made from samples secured from near-by quarries runs as follows:

Silica	61.82
Aluminum oxide	17.22
Ferric oxide	6.33
Calcium oxide	2.20
Magnesium oxide	2.91
Sulphur trioxide	2.61
Loss on ignition	5.64

Both the clays and shales contain all that could be desired to form with the lime rocks as nearly ideal mixtures as can be secured from any known deposits.

Cements that can be Manufactured

On account of the abundance and quality of the materials occurring as they do, uniform Portland Cement of the following kinds can be easily made and maintained uniform in chemical and physical qualities:

Light colored	Dark colored Portland Cements.		
High silica	Low silica	"	"
High alumina	Low alumina	"	"

And all will be A-1 Portland Cements containing much lower amounts of Magnesia than the cements of the Lehigh Valley.

Quantity of Materials

The limestones have a length of close to one and a half miles, with a width of 1,000 to 2,000 feet. The usable depth of the deposits is unknown, but borings have been made which show the deposits to be of the same character 40 to 50 feet below the level of the West Shore R. R. This gives a known depth of 100 to 200 feet of available limestone. The clays are known to extend far below the level of the river and to have a surface extent of approximately 200 acres.

Advantageous Physical Features

1. Lime rock can be placed in the factory by an aerial tramway at a cost for transporting of not to exceed $1\frac{1}{2}$ cents per ton, and, on account of the height of the lime rock above factory site and river, no drainage or hoisting charges will be necessary in the quarry operations. This will effect a large saving over the customary costs of raw materials for the majority of Portland Cement plants.
2. The clays occur right alongside of the mill where they are to be used, and the transporting charges on this raw material will be exceptionally low for years to come.
3. Water, often a vexatious problem to solve, both as to quantity and suitable quality for operating Portland Cement plants, is here in abundance, the Hudson River furnishing a supply of excellent boiler water.
4. Transportation. The Hudson River will afford this company many advantages and freight savings over its competitors from any other district.
5. Labor. Labor conditions, on account of the nearness to New York and the Eastern cement districts, could not be better, both as to supply and cost, for there is no section in the United States where there is so much possible choice for both skilled and unskilled labor as exists within a radius of 100 miles of New York City.

Costs of Production

With a plant such as is to be constructed on the property of the Seaboard Portland Cement Company, and with all the natural advantages which occur here, and with existing conditions, the costs of production should easily be kept to fifty-five cents per barrel.

Respectfully submitted,

H. E. BROWN.

Consulting Engineer.

B. Brentnall Lathbury,

M.Am. Soc. C.E.

PHILADELPHIA, PA., May 25, 1907.

SEABOARD PORTLAND CEMENT COMPANY,
NEW YORK.

Gentlemen:

In accordance with your request, I have made an examination of the property and deposits of your Company, and beg to submit herewith the following report:

Location: The limestone and clay deposits, comprising over 700 acres, are located in Greene County, New York. The clay deposits, of about 300 acres, border the west bank of the Hudson River for a distance of over three-quarters of a mile, and occur on the lower levels between the Hudson River and the main line of the West Shore Railroad; while the limestone deposits outcrop for over one mile along the main line of the West Shore Railroad, and extend back for about one-half mile.

Formation

Clay: The clay deposit covers the entire property east of the main tracks of the West Shore Railroad, and is in all respects similar in its physical and chemical character to the neighboring clay deposits along the west bank of the Hudson River. Yellow clay, with about twelve inches overburden, free from sand or grit and occurring in a very finely divided state, represents the upper strata, with a thickness ranging from 15 to 20 feet; while directly under occurs a blue clay of practically the same physical texture.

Limestone: The limestone, which dips towards the west, occurs in ledge formation for a height of over 125 feet above the tracks of the West Shore Railroad, and presents a strong outcrop along the railroad, with practically no overburden. The outcrop is strongly marked on the northerly end of your property, extending west along what is known as the Cobb Quarry; while on the east end, the outcrops can be distinctly traced beyond the limits of your property. The lower beds of the formation consist of a fine-grained, uniform limestone of a bluish color, while the upper beds are of a light gray color, coarsely crystalline and fossiliferous in character, containing a high percentage of calcium carbonate.

Samples

Average samples of yellow clay were selected from borings driven to depths of 12 feet each, and located at various places on your deposit; while samples of the blue clay were selected from the outcrops along the Hudson River, where the stratification is well defined.

Average samples of limestone were selected at various points over the outcrops, covering a large area of your deposit.

Analyses of Samples

CLAY

Sample	Silica SiO ₂	Iron Fe ₂ O ₃	Oxides of Alumina Al ₂ O ₃	Car. of Lime CaCO ₃	Car. of Magnesia MgCO ₃	Potash K ₂ O	Soda Na ₂ O	Sulphur Trioxide SO ₃
No. 1	50.20	7.30	19.76	10.11	6.88	3.01	1.56	0.24
No. 2	49.66	7.43	20.09	8.84	7.36	....	....	0.31
No. 3	45.72	7.35	21.05	9.84	7.54	....	....	0.40

LIMESTONE

Sample	Silica SiO ₂	Iron Fe ₂ O ₃	Oxides of Alumina Al ₂ O ₃	Car. of Lime CaCO ₃	Car. of Magnesia MgCO ₃	Potash K ₂ O	Soda Na ₂ O	Sulphur Trioxide SO ₃
No. 1	3.14	2.30	....	93.14	1.24	....	....	0.07
No. 2	2.24	1.90	....	94.40	0.68	....	....	0.06
No. 3	4.38	1.00	....	93.68	0.74	....	....	0.08

Comments: The analyses of both the clay and limestone samples show the entire body to be of satisfactory quality and entirely suitable when mixed together for manufacturing the highest grade of Portland Cement. The limestones are very pure and uniform in composition, containing low percentages of both magnesia and sulphur trioxide; while in the clays, the ratio of the silica to the alumina and iron is well conditioned for mixture with your limestones. While your limestone can be easily reduced, the clays are of an unusually fine texture and are entirely free from sand or other injurious ingredients. In quality, both your limestone and clay deposits are identical with those occurring on the adjacent property of the Alsen American Portland Cement Works, where an exhaustive investigation was made by me, prior to the construction of their plant in 1901. Core drillings were made over the entire clay bodies to a depth of 40 feet, and diamond drillings over the limestone deposits to nearly 300 feet. The plant of the Alsen American Portland Cement Works has been manufacturing 2,000 barrels of Portland Cement per day since 1901—a time sufficiently long to demonstrate the high quality of their cement made from materials which are identical with yours.

Shipping Facilities

The property is most advantageously located for both water and rail shipments. The Hudson River offers the unusual advantage of cheap water transportation to New York City, only 100 miles distant, for both local consumption or trans-shipment in New York Harbor to coast or foreign ports. You can also ship direct to Buffalo by water and thence by the Great Lakes to points beyond in the far West. As an illustration of the advantage your property possesses in having water transportation—the rate on cement from the Lehigh Valley District of Pennsylvania to New York City is 26 cents per barrel, while your rate via the Hudson River is less than 4 cents per barrel—a net saving of 22 cents per barrel. The West Shore Railroad, bisecting your property, insures low rail rates to New York City, Buffalo and all western points. The locality of your deposits is the only one in this country, where both water and rail transportation facilities are available to any large nearby center of consumption or distribution.

Manufacturing Conditions

The natural site for the location of your plant would be the high plateau on the clay beds overlooking the Hudson River. This location insures gravity transportation for your finished cement from the mill to boats on the Hudson River, and would also be both convenient and economic for constructing switch connections with the West Shore Railroad. The comparative elevation of the limestone deposit and its relative location to the clay deposit, presents decided advantages also for the establishment of a gravity system for handling your limestone from the quarry to the mill site; while the ledge formation offers the most economic condition for face quarrying. With the clay beds surrounding the mill, the cost of hauling this material is entirely eliminated.

Labor Conditions

Labor conditions appear entirely satisfactory in the neighborhood of your proposed plant. Directly north of your property about four miles, is the town of Catskill, which can furnish an adequate supply of labor. The Alsen American Portland Cement Works, adjoining your property, and the Catskill Portland Cement Works, located at Smith's Landing about one mile south of your property, have found no difficulty in securing ample labor. You also are located sufficiently near New York to command as much cheap foreign immigrant labor as you may desire to utilize. Therefore, your wage scale will be as low as any of the mills in this country.

Water

Your property is advantageously located along the Hudson River, which affords you an inexhaustible supply of water for domestic and mill purposes.

Fuel

Possessing the unusual advantages for receiving coal via the Hudson River and West Shore Railroad, you should obtain exceptionally low freight rates on coal from both the Pennsylvania and West Virginia fields.

Extent of Deposit

While diamond drillings have not been made on your limestone deposits, the formation is such that the outcrops are distinctly shown over the property and indicate a quantity sufficient for any size plant you may decide to erect. The clay outcrops are distinctly shown along the entire face of your property on the west bank of the Hudson River, and drillings over your clay deposits show identical results with those made on the adjacent property of the Alsen Company previously noted. In extent, you have sufficient clay to utilize all the limestone, which your property contains.

Conclusion

Summing up the advantages possessed by your property, it is well to enumerate the following:

Your deposits, located within 100 miles of New York City, the largest Portland Cement consuming and distributing center in this country, enjoy the unusual advantage of cheap water transportation to this point;

A Portland Cement can be produced from your limestones and clays under the most favorable conditions, and equal in quality to the highest standard grade of Portland Cement;

The extent of your deposits of both limestone and shale are ample for any capacity plant you may erect;

The natural topography of both the limestone and clay formations and their relative location to each other, presents unusual and excellent conditions for economic manufacture;

The location on the Hudson River and West Shore Railroad is most favorable for both the water and fuel supply;

Your property combines the unusual advantages for both water and rail transportation for your cement;

The climatic conditions are such that your plant can be continuously operated the entire year;

With a plant thoroughly equipped with all modern machinery, your cost of production should be equal, if not less, than the best performance of any plant in this country.

Respectfully submitted,

B. B. LATHBURY.

MAKER. 130 FULTON ST. N.Y.

The Use of
Portland Cement

In New York City
and Vicinity

Present and Future

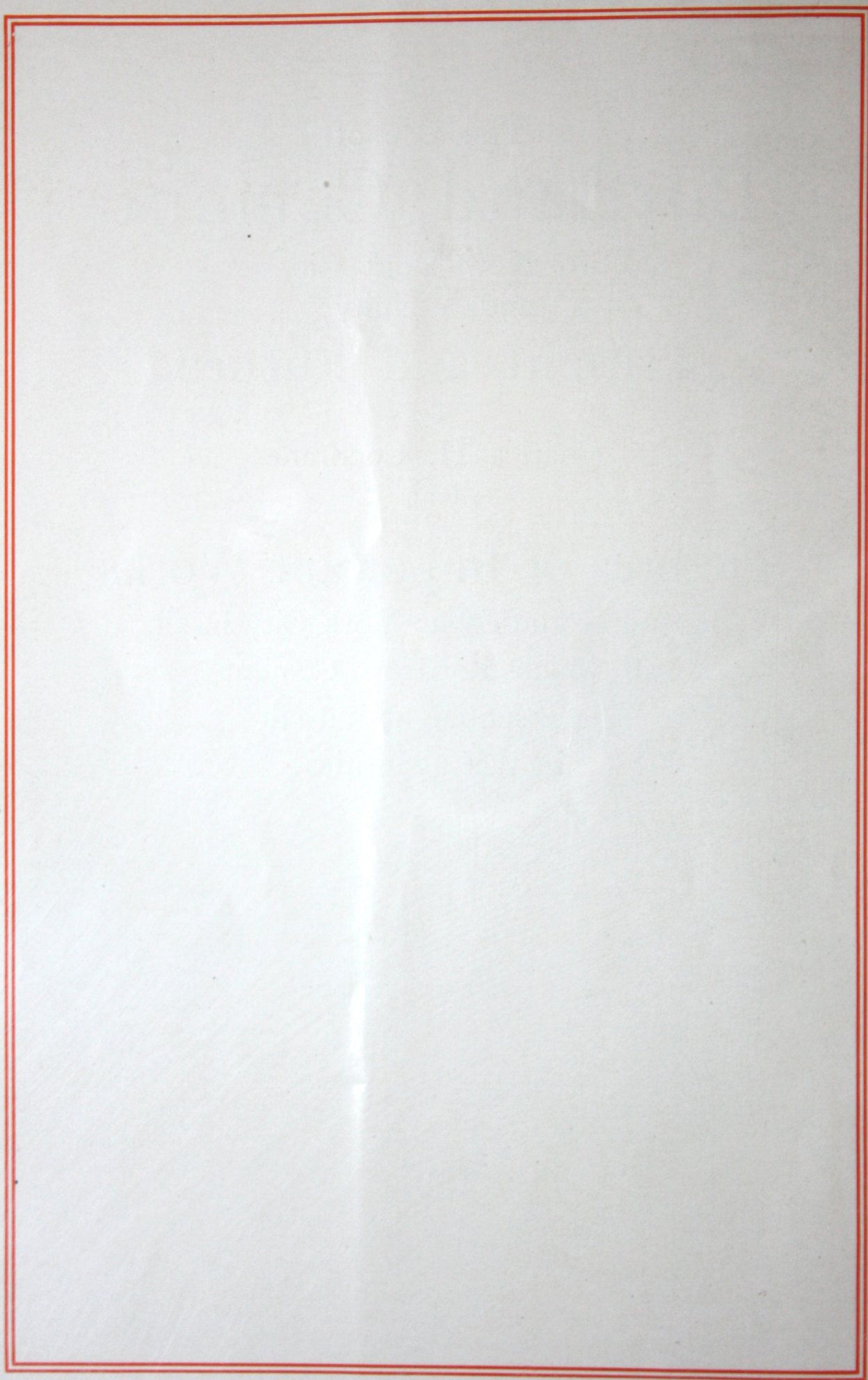
By

Charles H. Cochrane

With

Pictures of Important Works

in and around New York City in all
of which Portland Cement
is essential and used
in vast quantities



The Use of Portland Cement in New York and Vicinity, Present and Future

By Charles H. Cochrane

Author of "Modern Industrial Progress," etc.

COPYRIGHT, 1907, BY
SEABOARD PORTLAND CEMENT COMPANY

"There is good reason to believe that the opening of the 20th century marks the beginning of a cement age."—*Encyclopedia Americana*.

NEW YORK, the first city of the Western World, is being rebuilt. The legions of brick and brownstone buildings are falling in rows before the relentless scythe of modern progress. As the edicts for fire protection wiped out the wooden buildings of a half century ago, so the inexorable law of the survival of the fittest is discarding the brick and the quarried stone in favor of concrete made from Portland Cement, which is both better and cheaper, and which can be reinforced with steel to any degree of strength.

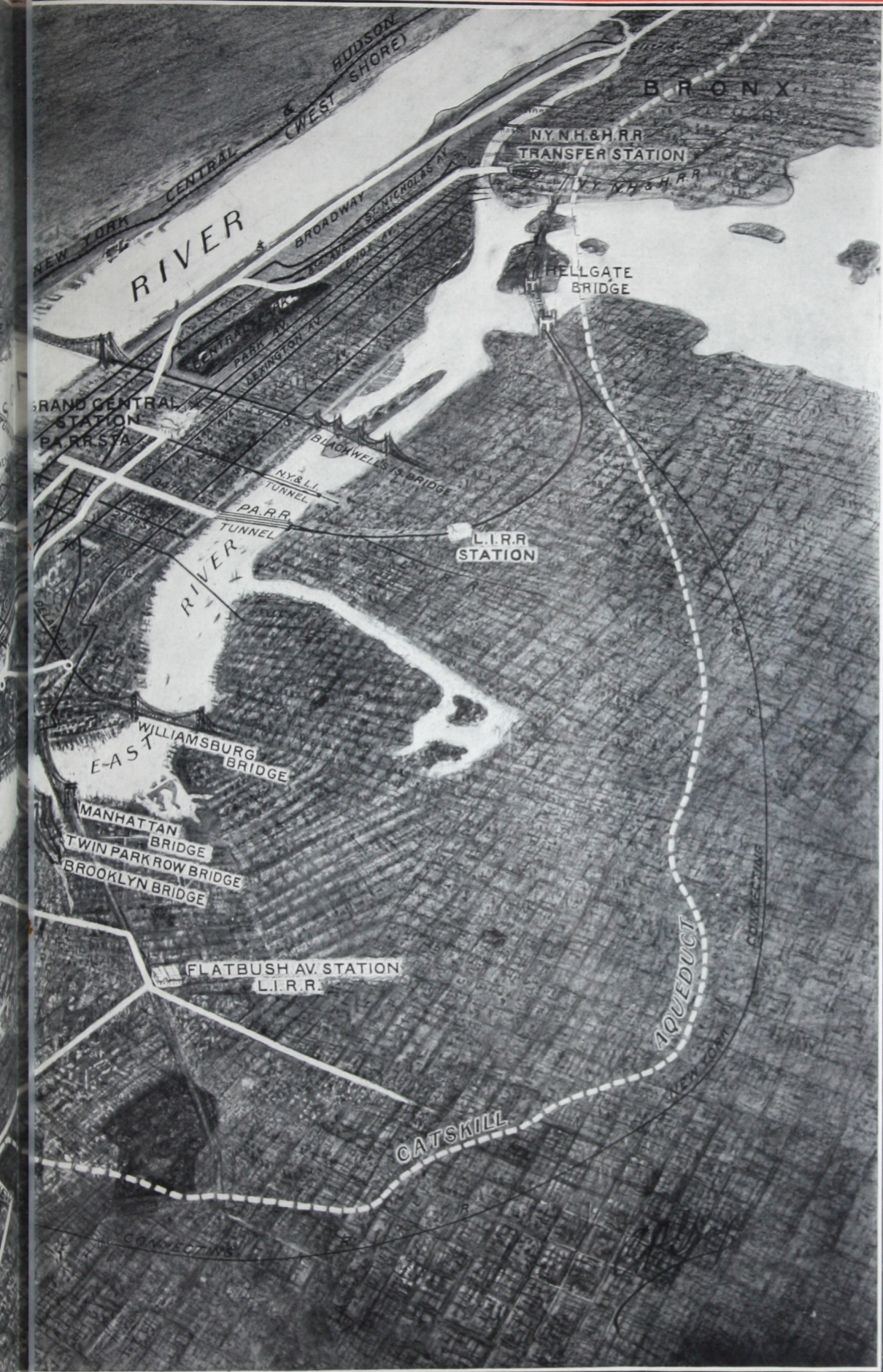
No such gigantic task of building and rebuilding has ever been undertaken before. Never in the history of the world has there been anything like the aggregation of great structural works of improvement centering about one place. The public and semi-public works just begun in New York City contemplate the enormous expenditure of between one and two billion dollars within the next ten years. And most of this is cement and steel construction.

History tells us of the Seven Wonders of the Ancient World—the Pyramids, Babylon's Hanging Gardens, Diana's Temple, the Colossus of Rhodes, the great Chinese Wall, the Leaning Tower of Pisa, and the Roman Aqueducts. The entire list sinks into insignificance before the monu-

mental works planned and under way in New York to be completed within the next few years, and to be followed in the coming decades with even greater and more costly engineering constructions, made necessary by the growth of population. The Pyramids were hundreds of years in building, yet one of them is no bigger than the huge anchorages of concrete sunk to hold the massive eye bars of the coming Manhattan bridge. Babylon's Hanging Gardens would have been lost in the great chasm excavated for the New York Central's two-decked underground railway yards. Half a dozen Diana's Temples could be accommodated in the great Pennsylvania railway terminal station going up between Seventh and Ninth avenues. The Colossus of Rhodes would make a good finial for the tower of the Singer or Metropolitan 700-foot skyscrapers. The great Chinese Wall, though it extended across half of Asia, is no larger than the concrete retaining walls of the New York Subways built and building within the limits of one mighty city. The Leaning Tower of Pisa would look lost set on one of the 800-foot towers of the coming Hudson River bridge, while the whole thirteen of the ancient Roman aqueducts would not pass as much water in a year as will flow through the great 17-foot Catskill aqueduct in a fortnight.



Bird's-eye view of Greater New York and vicinity, showing subways and bridges



bridges completed and under construction; white lines show subways.



Bird's-eye view showing the route of the new concrete aqueduct from the Ashokan Valley in the Catskill Mountains to Greater New York, and the location of the property of the Seaboard Portland Cement Company in relation to this aqueduct.

A Monumental Series of Public Works

NEW YORK has the proud distinction not only of outdoing all the Seven Wonders of the World in construction, but of actually having in hand twice seven monumental works—a series of wonders each of which is beyond precedent, outdoing and outrivaling any other works with which they can be compared. Here is the list:

1. The Grand Central \$50,000,000 terminal.
2. The Pennsylvania \$50,000,000 terminal and \$75,000,000 tunnels.
3. The McAdoo \$50,000,000 tunnels.
4. The Battery and Belmont tunnels, costing \$21,000,000.
5. The City's thirty-four proposed improvements, costing \$200,000,000.
6. The Hudson River \$75,000,000 interstate bridge.
7. The six new bridges to Brooklyn, costing \$130,000,000.
8. A series of smaller bridges, costing \$10,000,000.
9. The Catskill Aqueduct, costing \$162,000,000.
10. The Dock and Harbor improvements, both public and corporate, providing the largest steamboat docks in the world, costing \$10,000,000.
11. The State barge canal, virtually a New York improvement, costing \$101,000,000.
12. Twenty-nine coming skyscrapers, some 700 feet high, costing \$50,000,000.
13. Apartment hotels of Manhattan; \$100,000,000 worth are in sight.
14. Apartment houses of Brooklyn; \$150,000,000 of these are in sight.
15. The new public and private buildings of the Jersey suburbs, really a part of New York, promise to total over \$300,000,000 by 1917.

Most of the Outlay Goes Into Concrete Construction

RUNNING over the figures it is apparent that the total is about \$1,500,000,000, or considerably more than the interest-bearing debt of the United States. All of this vast amount of money must be spent in and around New York City within the coming years, and by the time these are completed, other vast undertakings will be under way. In all such work, Portland Cement is absolutely necessary, and without this material, many of these improvements would be impossible.

The fact that the public authorities and the corporations that serve New York have been forced to these improvements to make it possible to continue doing business in the area of 327 square miles now included in New York's territory, with a population of four and a quarter millions (five millions with the Jersey suburbs), that is growing at the rate of nearly a quarter of a million a year. Not only must the

corporations provide railway and tunnel facilities for moving this great body of people, and transporting their wares; not only must there be provision for water supply, sewerage and sanitation; not only must the city provide ample subways and bridges, but the real estate holders and contractors must erect houses for 50,000 new families every year. And at least 50,000 families of the present population are unhoused every year by the tearing down of old brick and brownstone structures, so that the builders have to erect new flat houses, apartment houses and dwellings every year to accommodate 100,000 families.

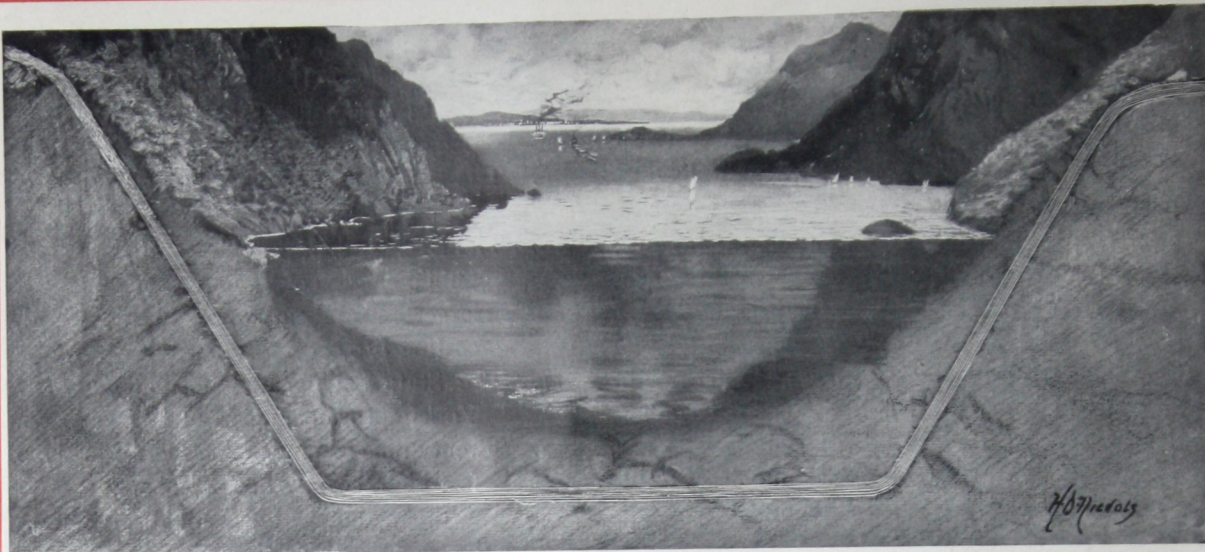
And concrete made with Portland Cement is the material that is going into the houses of these 100,000 families, and that is furnishing sidewalks to front the new structures.

All Authorities Support These Statements

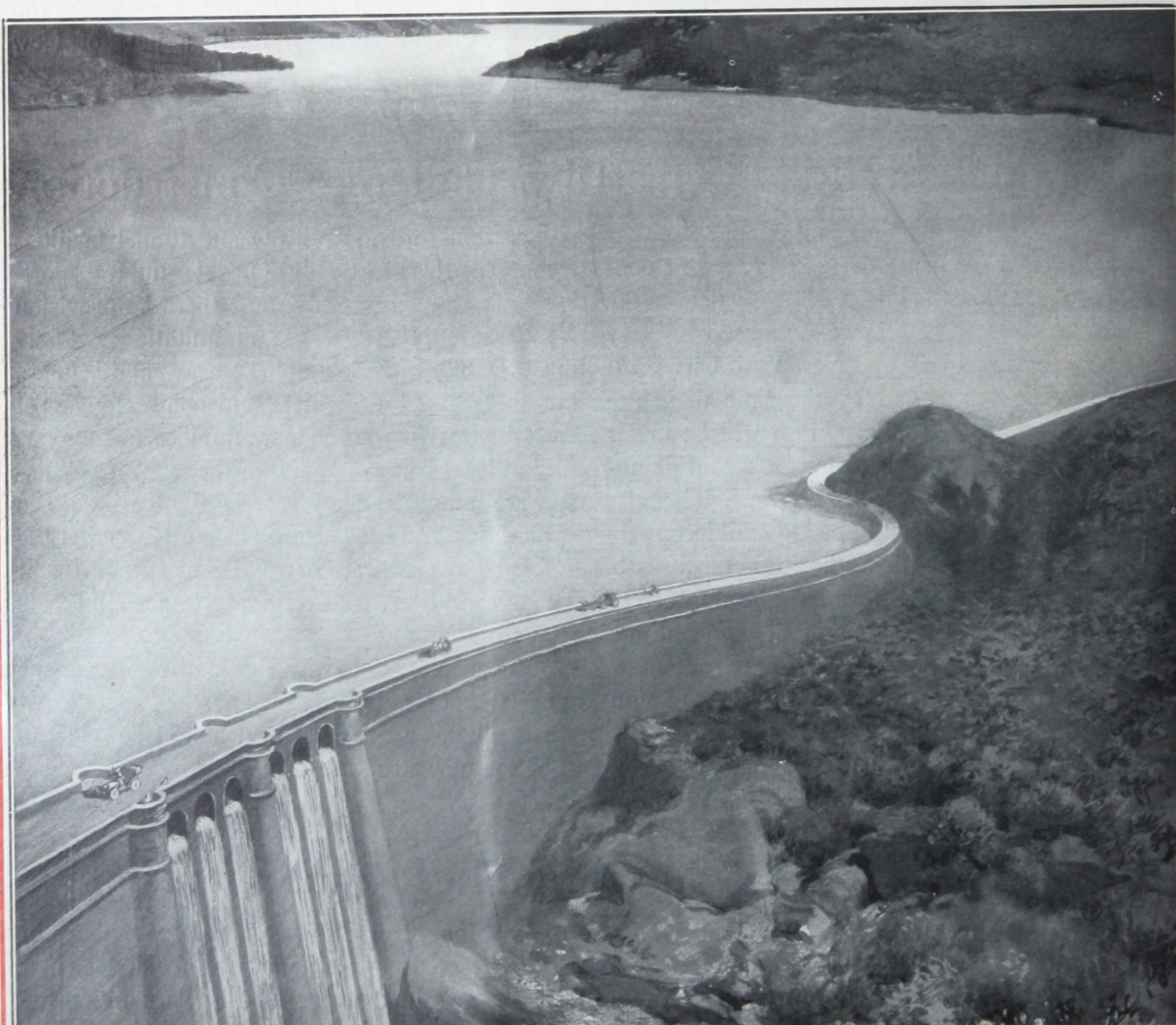
NO wonder that the ENGINEERING MAGAZINE says: "If you want to know where the greatest engineering feats of the world are being accomplished or are to be accomplished you will have to come to New York. The world will probably never see greater things being done than are now actually being constructed right here." And the New York SUN in commenting on this adds: "The outlook is that long before the completion of the \$625,000,000 worth of work (described) already

provided for there will be hundreds of millions of dollars more of engineering work to be done. Not only is New York at present the place where the greatest amount of engineering work is actually going on in the entire world, but probably for nearly a generation it will continue to hold primacy."

NO wonder that James Bryce, the new ambassador from Britain, says: "In thirty or forty years the population within a 20-mile circle



This monster siphon, which is part of the Catskill Aqueduct, will pass under the Hudson River at Storm King. It is to be blasted out of solid rock to a depth of 1,000 feet below the aqueduct gradient. (Courtesy Broadway Magazine.)



The Ashokan Dam will be nearly two miles across the face and almost 200 feet high, protecting the reservoir which covers 23 square miles of land. This is one of eight great reservoirs included in the Catskill water scheme, to feed the giant concrete aqueduct, an illustration of which is shown herein. (Courtesy Broadway Magazine.)

Pictures on these two pages illustrate work to be done in connection with the new water supply for New York. This aqueduct will be 85 miles long and be built entirely of concrete, the inside measurement being over 17 feet. It will require much more Portland Cement to construct this aqueduct than will be required for the entire Panama Canal.

of the center of Manhattan will be the largest aggregation of population upon the earth." No wonder that the NEW YORK AMERICAN, commenting on Ambassador Bryce's speech, adds: "His views are similar to those of thousands of visitors impressed by the city's greatness who have arrived at this conclusion after only a cursory investigation, but close students of realty movements are possessed of the fact that there is an enormous recon-

struction movement in this trade center, unequalled in any part of the civilized world."

No wonder that Commissioner of Immigration F. P. Sargent thinks that New York will overtake London in less than 20 years, basing his estimate on the fact that our immigration now totals 1,100,000 a year, of which 900,000 land at New York.

New York's Population Growth

BETWEEN 1900 and 1905 Greater New York gained 563,201 in population, or 16 per cent., that is a trifle over 3 per cent. per annum. In 1903 E. L. Corthell, the eminent engineer and statistician, figured that its growth was 3.7-10 per cent. a year; in 1906 he revised this figure, admitting that the coming of bridges and subways was producing a faster growth, and that it was then 4½ per cent. a year. The ratio has continued to increase, and is now calculated at 5 per cent. a year, and with the opening of every new bridge, tunnel and subway the ratio gains, because the added capacity for transportation invites more population.

The BROADWAY MAGAZINE estimates New York's population in 1920 at 8,650,000. The New York AMERICAN figures it at 8,855,893 in 1927; Frederick Boyd Stevenson in the BROOKLYN EAGLE produces estimates of a similar sort, going to demonstrate a population of over 8,000,000 in from 15 to 20 years.

All the authorities are agreed that New York City is the fastest growing city in the world, and that the tendency of an increasing population throughout the country is to flock to the city. New York, as the greatest city of the West, through whose harbor flows almost all of the vast commerce between the two greatest continents, MUST double in population, and the only question is as to how many years are required for the doubling process.

This means that within a short period of years another and greater New York—a New York of cement and steel—must be built to take care of the doubled population, and during the same time that half of the existing structures will be turn out and replaced with newer and better materials.

It is of interest to give a little space to consideration of the great engineering and construction work, in and about New York City—the works that typify the prodigious energy and prosperity of the Western Hemisphere.

The Grand Central R. R.'s \$50,000,000 Terminal

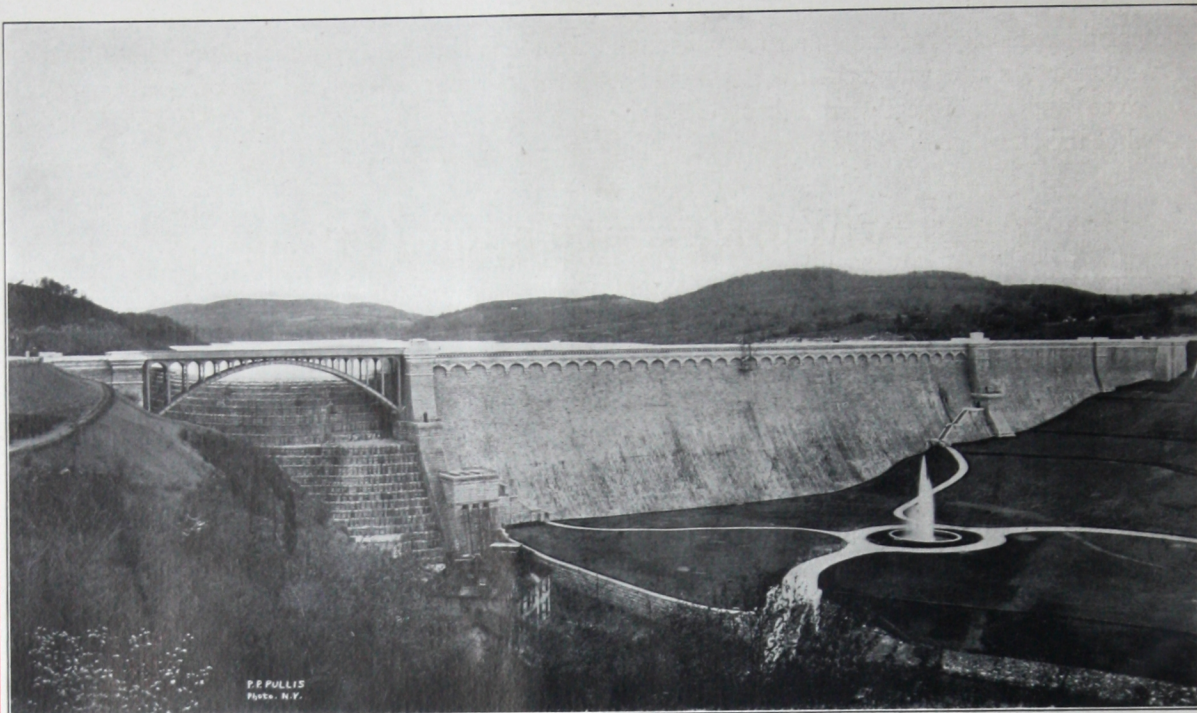
THOSE who are daily obliged to submit to the jamming and crowding in and around the New York Central's terminal station in New York City, especially during the late hours of the afternoon, know that this improvement is coming none too soon. The new terminal is truly colossal, the station buildings proper covering six city blocks, and the railroad yard, arranged in two levels or decks, being a half mile long and a quarter mile broad. In 1905 the excavation of this yard began, and is carried along, a few tracks wide at a time, so that the system is kept in operation while the construction continues. Literally thousands of tons of cement have gone into the foundations and retaining walls of this great railroad yard, which is decked over with steel beams, supporting concrete floors for the buildings and structures above.

A total of over 2,000,000 cubic yards of earth and rock removed is required for the yards, and this does not include the still deeper excavation that the Belmont tunnel is making under the south-

ern end of the station in order to connect the Grand Central with the Long Island and the electric railways of Queens Borough.

The terminal building proper is designed to remind one of the Parthenon of ancient Rome, being severely classical in its main lines. It is being built of concrete and steel, like all great modern structures; the foundations about fifty feet below the sidewalk are beds of concrete, made with Portland Cement and laid on the solid rock. On these rest piers—great monoliths of concrete—and from these spring the stupendous steel arches and trusses that rise majestically to the vaulted roof.

The principal part of the terminal on 42d Street will include three great arched apertures, each 40 by 60 feet. The real doorways will be on a level below, and extend entirely across the building's width. Immediately on entering is the ticket lobby, leading into the main concourse, a vast waiting room surrounded by grand groined arches that meet 150 feet above the tessellated floor. At the



Croton Dam. This great concrete wall—which, in the construction of the new Catskill Reservoir, will be destroyed—is but a quarter as large as will be the Olive Bridge Dam of the Ashoken Reservoir, which will be of cement construction.



New York Sky-line from East River.

level of the column capitals, from which the arches curve away, is a capacious gallery reached by four massive marble staircases. From this gallery one may look out into the long train-shed, through which a never-ending tide of humanity will flow—more than 100,000 a day now, and soon to be 200,000, when the construction work is all completed, so that the New York Central can handle the passenger business that awaits it.

For the suburban service the new electric installation has been made, and all trains within easy connecting distance are to be operated with electricity furnished from one of two immense power houses, one at Port Morris and one at Yonkers. These tremendous power houses, each a superb structure of steel and concrete, involve the use of tons and tons of Portland Cement, without which no important modern structure can be designed.

The Pennsylvania Railway's Terminal Improvements

BY the time that Pennsylvania electric trains are running under the Hudson, stopping at the new terminal station in Manhattan and continuing on to Long Island City, Brooklyn, and also Boston, via the tunnels under the East River, about 1909 or 1910, the total bill of this great railway's New York improvements will be in the neighborhood of \$120,000,000 to \$130,000,000.

In 1901 the Pennsylvania road intended to come into New York by a bridge over the Hudson at 23d Street, but finding that other railways must be permitted to use an interstate bridge, tunnels were decided on, and in 1902 plans were perfected for two tunnels under the Hudson, entering New York at about 32d Street, and crossing the city as subways. On the East River side four tunnels were arranged, as both the Long Island railroad trains and New York, New Haven & Hartford trains were expected to use them.

An electric zone is established between Harrison, N. J., a suburb of Newark, and Long Island City, all trains within that area to be operated by electricity. Land was purchased for a mammoth terminal between 7th and 9th Avenues and 31st and 33d Streets, Manhattan, the area reserved for the building being eight acres in extent, sufficient for the largest terminal station in the world. As the train service will be entirely underground, it has been excavated to a depth of 40 feet, at which level the tracks run, the spacious building surmounting them and rising about 95 feet above the street level. As a result of this submergence, the Pennsylvania terminal appears low, but its designers succeeded in providing a beautiful creation, architecturally imitating Hadrian's Villa, the greatest creation of Roman art.

Of course the material for the construction of this enormous building is cement and steel. At this writing the workmen are laying the concrete away down below the track level, right on the virgin rock, so that this peerless structure may have the solidest of foundations. Ornamental stone

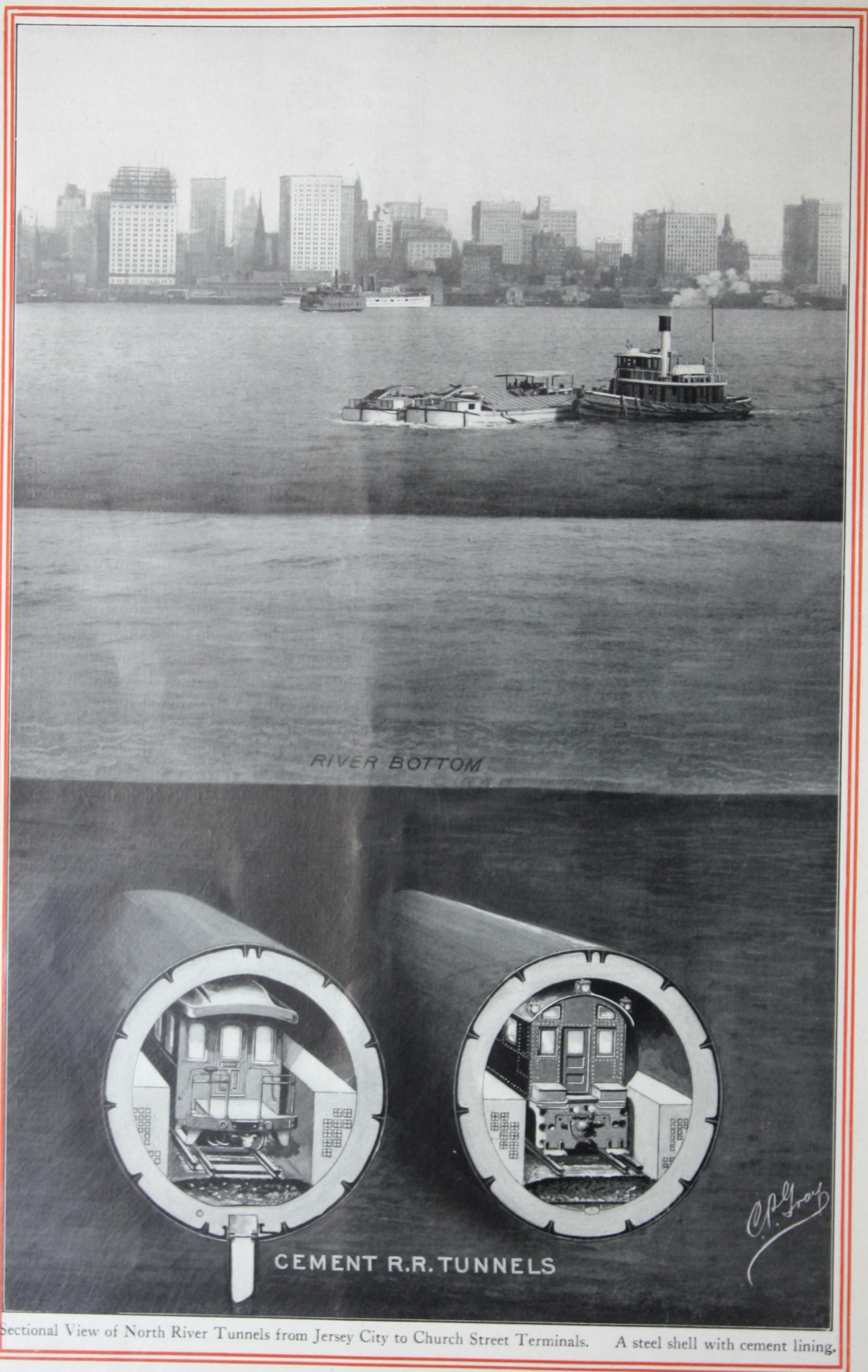
will be used in the outer work, but in the heart of the structure, it is always concrete or Portland Cement and steel.

The Pennsylvania subways clear across the city are practically arched over and walled with concrete, there being several miles of this underground work. The tunnels proper are made of cast-iron segments, bolted together so as to form rings about two feet wide, and perhaps an inch and a half thick. The outside diameter of the rings is 23 feet. When the rings are in place under the Hudson they are anchored by running screw-piles down to the solid rock. These screw-piles are iron tubes of about two feet diameter, with one turn of a screw at the lower end. They are made in short lengths, and forced down through holes in the bottom of the tunnel until they rest on the rock. They are then filled up with concrete, after which they are expected to rest for all time.

The thin iron tube of the tunnels serves only to give it shape. The real tunnel walls are made of concrete, which is filled in between flanges, to a thickness of more than a foot. This is the modern method of building tunnels, so that they are practically concrete tubes, strengthened by iron, which for this purpose is preferred to steel.

Benches of concrete are formed along the lower sides of the tunnels, with apertures for the accommodation of pipes, wires, etc. The tunnel floor, on which the ties and rails are set, is of concrete, and forms the solidest of beds for swift and heavy trains.

The four Pennsylvania East River tunnels have been considered by engineers as the most difficult job of tunneling ever undertaken, and no contractor could be found to bid on the work, so that it is being done under the charge of engineers, the Pennsylvania Company paying the bills. It is thought that these four tunnel tubes will cost at least \$50,000,000.



Sectional View of North River Tunnels from Jersey City to Church Street Terminals. A steel shell with cement lining.

The McAdoo Interstate Tunnels

WHEN the Pennsylvania Railway decided to come into Manhattan by its own tunnels, the Erie, the D., L. & W. and the surface electric roads of Northern Jersey, which had expected to cross the Hudson by an interstate bridge, were left to depend upon the ferries. This condition caused William G. McAdoo to resurrect an old tunnel franchise at Morton Street, then to secure another at Cortlandt Street, and to form two companies for constructing these Hudson River tunnels. His most herculean task was in inducing the several competing railways to act together, so that the Erie, the Lackawanna, and the Pennsylvania agree to a joint use of the tunnels, which are to be connected by Jersey subways with all the Jersey City terminals of all these roads. The Public Service Corporation, which controls most of the electric street railways of Northern Jersey, is also permitted to use these tunnels, and only the Philadelphia & Reading remains without prospective tunnel connection with New York.

There are four of these McAdoo tunnels, all of iron and concrete, which are to be finished and opened in 1908. The tubes, which are about 16 feet outside diameter, are laid in pairs, two running from the Pennsylvania's Jersey City terminal to a new terminal building at Cortlandt and Church streets, in the downtown section of Manhattan; the other pair leaves Jersey City from a point between the Erie and Lackawanna stations, and enters Manhattan at Morton Street, passing up under Sixth Avenue as a subway, to connect with the Pennsylvania system at 32d Street.

The downtown system of McAdoo tubes will have a splendid terminal station, connecting directly with the Broadway subway. Twenty-story twin buildings are being erected, covering the two blocks

on Church Street from Cortlandt to Fulton Street. The two tunnel tubes will reach Manhattan near the foot of Cortlandt and Fulton streets, respectively, and will connect in a loop under the Hudson terminal buildings, as they will be styled.

Passengers will enter at the street level and go downstairs to any of a series of loops 32 feet below the street level, and there they can take electric trains in either direction. If they go over to Jersey City, the first stop will be right under the present Pennsylvania terminal, which they can enter by elevator; or they can continue on in a Jersey subway to either the Lackawanna or Erie terminals; or they can ride on to Harrison in electric cars, and reach the Pennsylvania main line there; or they can change cars to any of the Jersey surface electric roads.

The uptown McAdoo tunnels, enter Manhattan at the foot of Morton Street, near Christopher, and continue by subway to a station at the junction of Sixth Avenue, Broadway and 32d Street, one block east of the great Pennsylvania terminal. This subway construction costs about \$1,500,000 a mile and like all the other subways is mainly concrete made of Portland Cement, steel columns and girders serving to support the streets above.

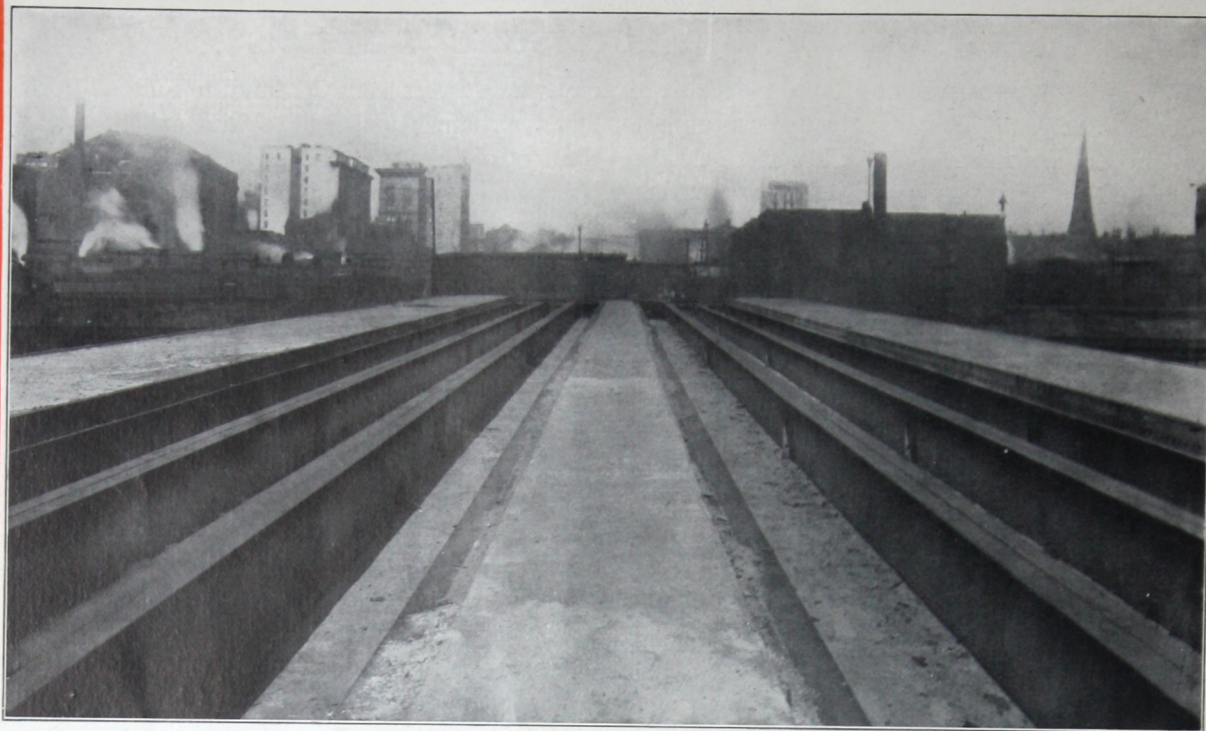
The entire cost of the four McAdoo tunnel tubes with the connecting subways on both sides of the Hudson, and with uptown and downtown stations, will be approximately \$50,000,000. With six-car electric trains, running under the river at 15 miles an hour speed, and under 60 seconds headway, they can carry 36,000 people under the Hudson in one direction during any rush hour. All this has been made possible by the employment of modern reinforced concrete, without which such enterprises would be fraught with untold difficulties.

The Battery and Belmont Tunnels

THE New York Rapid Transit Commission, after contracting with the Belmont syndicate for the building of the original or Broadway subway, at a cost of \$35,000,000, next turned its attention to a Brooklyn connection, and the Battery tunnel plan was devised. This runs from the Battery on Manhattan Island, where it connects with the southern end of the Broadway subway, under the East River, to the foot of Joralemon Street, Brooklyn, thence by subway to and up Fulton Street to the Flatbush Avenue station of the Long Island Railroad, this being a branch of the Pennsylvania system.

The Belmont syndicate is constructing this double tube system, at a cost of \$11,000,000, and it

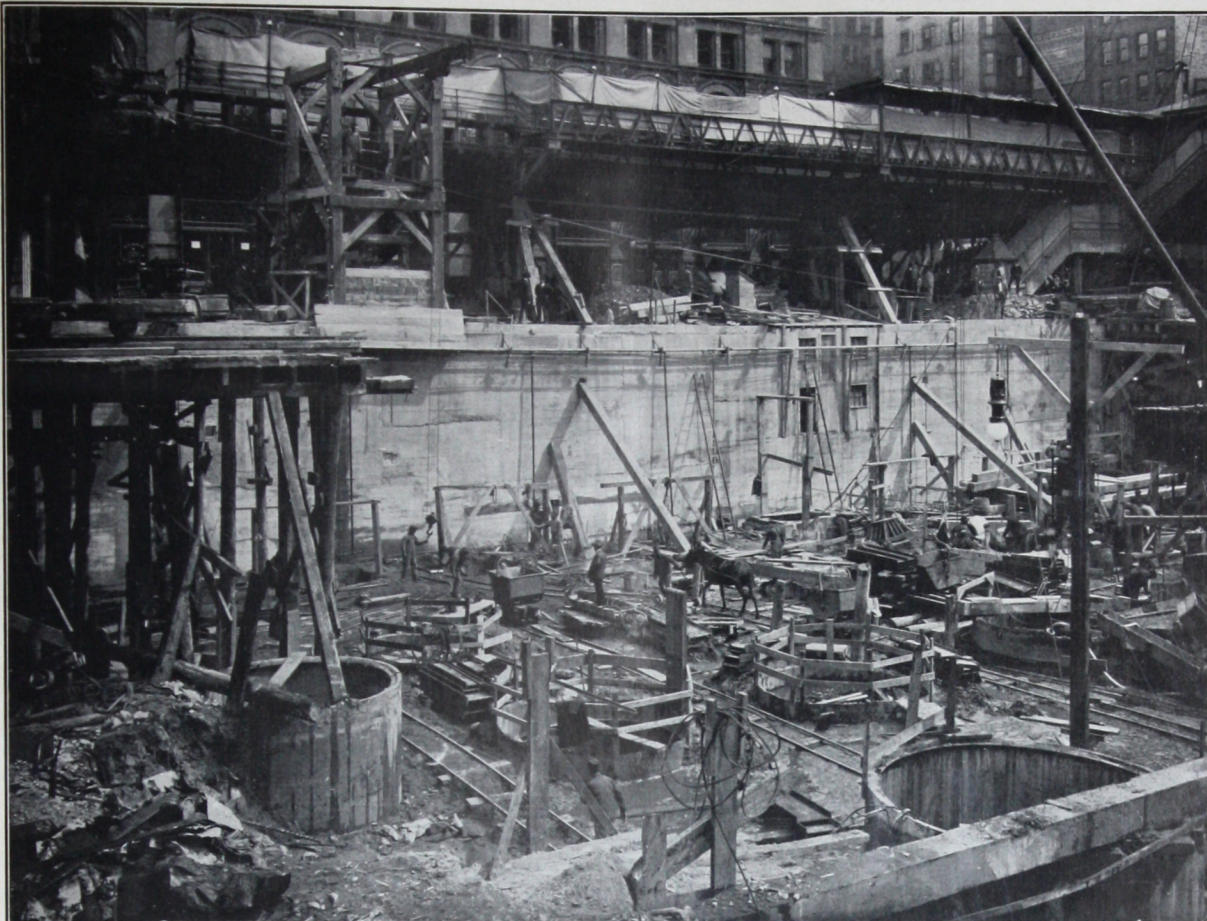
is to be opened late in 1907. By this means Long Islanders can connect with any part of the Manhattan subway system, without crossing the overcrowded Brooklyn Bridge. Brooklyn also becomes a main line station on the Pennsylvania system, since the Flatbush Avenue station is to be made a great central terminal for the borough. The new Manhattan Bridge plaza will connect with this terminal, and there will be direct trains over the Long Island tracks to Long Island City, and via the Pennsylvania tunnels to Philadelphia; also over the New York Connecting Railroad, via the coming Hell Gate Bridge, to the main line of the New York, New Haven & Hartford Railroad, in the Bronx, and on to Boston.



Concrete Viaduct across Lexington Avenue and Forty-fifth Street, N. Y. C. & H. R. R. R.
Concrete Construction in Connection with the N. Y. C. & H. R. R. R. Terminal at Forty-second Street, New York City.



Concrete Retaining Wall, N. Y. C. & H. R. R. R. Lexington Avenue and Forty-fifth Street.



Work on Foundation of Church Street Terminal Building, showing great concrete retaining walls and caissons for concrete foundations.

All this terminal business will connect direct with lower New York by the Battery double tube tunnels, which are 16 feet in diameter and of iron, concrete-filled. Electric cars will run through from Flatbush Avenue to the Battery in about 12 minutes, with a capacity of about 18,000 passengers one way per hour.

On the north, Long Island will have another tunnel connection with Manhattan besides the Pennsylvania tubes. A Belmont company is constructing a pair of tubes on the old Steinway franchise, at 42d Street. This affords direct connection between the Grand Central Depot and the surface electric railways of Queens Borough. The Belmont tunnel will be opened to traffic some time in 1908, and will enable residents of Long Island City to ride by electric cars directly to the heart of Man-

hattan. The improvement will cost in the vicinity of \$10,000,000, and involves the usual large outlay for Portland Cement for the tunnel lining, and for the subway construction in the approaches, and under 42d Street, Manhattan.

Both the Battery and Belmont tunnels were designed and largely constructed by William Barclay Parsons, the eminent engineer, who was one of the first to recognize the immense value of concrete construction for subways and tunnels.

The Rapid Transit Commission has made more or less extensive surveys of four other tunnel routes between Manhattan and Brooklyn, some of which will doubtless be approved and carried through within a decade. That most needed would appear to be about 14th Street, Manhattan, arriving in Brooklyn just south of Williamsburgh Park.

\$200,000,000 for Thirty-four City Improvements

IN April, 1907, Mayor McClellan requested a list of the Board of Estimate showing the improvements contemplated in New York City within a few years, meaning those improvements over which the city government exercises control. The list which is given below totals \$200,000,000, and the expense must be provided for by issues of corporate stocks before 1910.

1—Subway loop, Manhattan section	\$5,000,000
2—Subway loop, Brooklyn section..	10,000,000
3—Rapid transit line, Manhattan and the Bronx.....	35,000,000
4—Pipe galleries in same.....	8,000,000
5—Rapid transit line to Coney Island.....	15,000,000



Excavation for Pennsylvania Railroad Terminals, New York, showing cement retaining wall.



N. Y. C. & H. R. R. R. Double-deck Terminal Yard, showing Concrete Turn-table.

In this work thousands of tons of Portland Cement will be used.

Concrete Construction Work in Connection with the N. Y. C. & H. R. R. R.'s New Terminal at Forty-second Street.

6—Reconstruction Brooklyn Bridge terminal.....	\$3,250,000	33—Completion of Public Library Building.....	\$3,000,000
7—Office building at Manhattan end of Brooklyn Bridge.....	3,500,000	34—Margin to be allowed within debt limit.....	10,000,000
8—Land for structural approaches to Manhattan Bridge.....	6,000,000	Total.....	\$199,650,000
9—Land for Manhattan approach to Blackwell's Island Bridge..	3,000,000		
10—Construction of approaches to Manhattan and Blackwell's Island bridges.....	4,700,000		
11—Hudson Memorial Bridge.....	3,000,000		
12—City's share of viaducts across Grand Central yard.....	600,000		
13—Repaving streets, all boroughs..	8,000,000		
14—Relief sewers.....	3,000,000		
15—Water-front improvements.....	12,000,000		
16—School buildings and sites.....	20,000,000		
17—Police and fire engine houses....	4,000,000		
18—Brooklyn Municipal Building...	1,500,000		
19—Bellevue Hospital.....	1,600,000		
20—Park construction, all boroughs..	1,500,000		
21—Metropolitan Museum.....	1,500,000		
22—Zoological Society.....	250,000		
23—Department of Health.....	2,000,000		
24—Department of Charities.....	500,000		
25—Department of correction.....	250,000		
26—Extension of Riverside Drive to Harlem River.....	5,000,000		
27—Land required for Riverside Drive extension.....	1,500,000		
28—Park between Riverside Drive and the Hudson River.....	3,500,000		
29—Owl's Head Park.....	2,000,000		
30—Seaside Park at Rockaway.....	1,500,000		
31—Street and park opening fund...	15,000,000		
32—Assessment bonds to meet cost of local improvements above receipts from assessments....	5,000,000		

It should be definitely understood that this \$200,000,000 does not by any means cover the improvements that must be made by the city. It does not include the Catskill water supply, which is provided for by a State Law, and is out of the hands of the city authorities. Nor does it take note of 17 other subway routes which have been approved by the Rapid Transit Commission, and which will be built at a cost of some hundreds of millions after this \$200,000,000 is disposed of. This is simply that portion of New York's City's improvements for which the Board of Estimate has to provide the funds for the years 1907, 1908 and 1909.

As proof that at least 10 of the 17 subways are coming, Chief Engineer George S. Rice, of the Rapid Transit Commission, says: "It is imperative that within the next decade there should be built six 4-track subways for Manhattan and the Bronx, and for Brooklyn four 4-track subways, making ten new subways in all, which will only then about accommodate the vast increase in passenger traffic caused by the city's giant growth."

It is noteworthy that not a single one of these improvements is to be or can be carried out without Portland Cement to make the concrete. So thoroughly is the new material established in usage that not a single important building, foundation, or even a park pathway, is to be made without calling for a greater or less quantity of this modern necessity.

The \$75,000,000 Interstate Bridge

THE project of a bridge across the Hudson at New York has been discussed for more than 40 years. Only now it is near realization. The New York and New Jersey Bridge Commission, specially chosen to consider the work, reported favorably early in 1907, and the North River Bridge Company has a Congressional charter for its construction, while ex-Bridge Commissioner Gustav Lindenthal has worked out the designs.

It will be by far the largest bridge ever built, having 3,000 feet span, as against 1,600 for the Brooklyn and the Williamsburgh bridges. The monster piers will be of concrete topped with granite, and will support four steel towers, each of which will be 800 feet from foundation to finial. Eight steel wire cables, each about 2½ feet diam-

eter, will support this king of bridges, which will be 140 feet wide, with two decks, or stories, giving it a total of 280 feet width of tracks and roadways.

These eight enormous cables are to be anchored on each side of the river in deep beds of concrete, binding the eye-bars and cross-bars, so that the vast weight of the bridge and its moving load of passengers and freight may be counterbalanced. This will require a bed of concrete on each shore that will vie in dimensions with some of the larger Pyramids of the Pharaohs, which each required a score or two of years for construction, while modern mechanics will duplicate them in concrete underground in less than two years. The approaches to this bridge, involving causeways and plazas, will utilize many thousand tons of Portland Cement in the construction.



Concrete and Steel Fence—Long Island Railway.



Concrete Elevated Railroad Station.

The New Bridges to Brooklyn

THE glut of traffic over the old Brooklyn Bridge, now officially known as East River Bridge No. 1, totals over 400,000 a day, while the Williamsburgh Bridge transports over 100,000 daily. To distribute this traffic more equally a subway loop is to be constructed, at a cost of \$15,000,000, to connect the terminals of these bridges, and also the Manhattan Bridge that is to be finished about 1910, and which crosses the East River between the others named. A new terminal is to be built on Park Row for the old Brooklyn Bridge, at a cost of \$3,250,000. The Williamsburgh Bridge will be improved by completing the upper level for the passage of elevated trains. The Manhattan Bridge is to cost \$20,000,000. The piers and anchorages of this bridge are the largest yet built, and are almost entirely of concrete. Each anchorage cost over \$1,000,000, and required 43,000 cubic yards of concrete work.

A little farther upstream the Blackwell's Island Bridge is progressing. This is to cost \$15,000,000, but if the plan is carried out for an ornate extension along 59th Street as far as Central Park, as seems probable at this writing, there will be a few more millions involved, mostly of concrete construction.

North of Blackwell's Island a bridge is to be constructed by the New York, New Haven & Hartford R. R., over East River at Hell Gate. This will be the largest single steel arch bridge in the world, being 1,000 feet span. The railroad must build

three bridges in all, connecting their lines in the Pelham section of the Bronx with Ward's and Randall's Islands, and thence across Hell Gate. From this point a railway line is to be run to Long Island City, connecting with the Pennsylvania tunnels; and a branch line will skirt all around Brooklyn, reaching the Bay just south of the Bushwick Terminal plant. This railroad extension is to be known as the New York Connecting Railroad. The bridges and the railway with electrification improvements may cost the N. Y., N. H. & H. R. R. \$15,000,000 or \$20,000,000.

To afford more relief for the Brooklyn Bridge crush, a commission has been appointed recently to investigate the advisability of another East River bridge right alongside the first bridge, connecting Park Row and Sands Street, and there is no doubt that an expenditure of about \$20,000,000 will be authorized in the near future for this purpose.

In addition to these an agitation is again stirred for the building of a pair of bridges joining Governor's Island to both Manhattan and Brooklyn. The work has not yet been authorized, but it must come sooner or later with the growth of population. These two bridges would be costly, requiring probably \$40,000,000 or more, so that the total bill for bridges connecting Brooklyn with Manhattan is likely to be about \$130,000,000 before 1915. It will not stop there either, and Thomas A. Edison says it will go on until the East River is virtually wiped off the map.

Other Bridge Improvements

THE Bridge Commissioners of New York City have between 50 and 60 bridges under their control, and there is never a time when half a dozen or so are not being rebuilt and reconstructed. This creates a large permanent demand for cement. In addition to the \$200,000,000 worth of great bridges that have been described, there are a number of minor bridges that have been or will be authorized soon. One of these is the Hendrick Hudson Memorial Bridge, crossing Spuyten Duyvil creek and

gorge, that will have an 800-foot span, and is to cost \$3,000,000. The abutments and approaches are to be of concrete, of course.

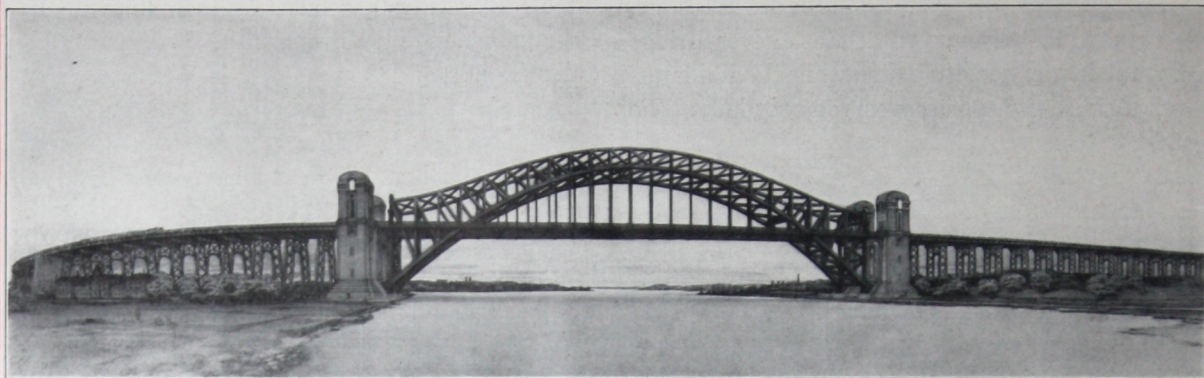
Then there are two interstate bridges that have been reported on favorably, one to connect Staten Island with Bayonne, and the other to join the island with the mainland of Jersey. Several more bridges will span the Harlem in the near future, and the railways coming into Jersey City must construct some more bridges over the Hackensack.

The \$162,000,000 Catskill Aqueduct

THE greatest single engineering work about New York City is undoubtedly the Catskill water supply, authorized in 1905 by a State law, and for which \$161,500,000 is being raised by water bonds. No other water supply approaches this in magnitude. It almost equals the Panama Canal in

expense, yet it has moved along so quietly that few people realize its immensity, and what it means to New York.

Picture to yourself a reservoir in the Esopus Valley, covering ten villages, for which 23 square miles of land have been condemned, and one rail-



Pennsylvania R. R. Hell's Gate Bridge, New York to Long Island City.



Manhattan Bridge, New York to Brooklyn.



North River Bridge, Weehawken, N. J., to New York.

The North River Bridge, Weehawken, N. J., to New York, will be the most wonderful bridge ever built, being twice the size of either the Brooklyn or Williamsburg bridges. The monster piers will be of concrete. The estimated cost of this structure is \$75,000,000.



Long Key Viaduct. Florida East Coast Railway.

Total length, 10,500 feet. 286,000 barrels of Portland Cement, manufactured by a Company using *identically the same raw materials* as those on the property of the Seaboard Portland Cement Company, used in its construction.

way has to be bought and submerged. Imagine a great dam, nearly two miles across the face and almost 200 feet high; back of this an artificial lake containing enough water to fill Broadway from curb to curb in a stream three feet deep and flowing at three miles an hour for nearly a year before the reservoir is emptied. Such is the Ashokan Reservoir, and it is only one of eight great reservoirs included in the Catskill water scheme, to feed the gigantic concrete aqueduct that is to run from the heart of the Catskills 85 miles to Manhattan, depositing its waters first at Kensico, to connect with the present Croton supply; thence to Scarborough, to be filtered in a \$17,000,000 plant; thence to Hill View Reservoir, for a high-pressure service to Manhattan; thence by a siphon under the East River to Brooklyn, where Forest and Ridgewood reservoirs are to be supplied; thence by a capacious water main laid along the harbor bottom to Staten Island, reaching and supplying the farthest points in Richmond Borough.

This gigantic aqueduct, an artificial river, is made of concrete 17 feet inside diameter, and from one to three feet thick. It will take six or eight years to build, and the cement used in its construction will run into millions of tons. The eight great reservoirs also are mainly of concrete construction, and as they are to be built in succession, as needed, during the next 20 years, they will of themselves constitute a large steady demand for cement.

The most unique feature of the aqueduct construction will be a monster siphon passing under the Hudson River at Storm King, that is to be blasted out of solid rock to a depth of 1,000 feet below

the aqueduct gradient, to escape all possible contact with the river water. This siphon or underground conduit will be lined with cement to enable the water to pass through without too much friction, which would reduce the speed of its flow.

Commissioner Charles N. Chadwick, of the Board of Water Supply, states that the first installment of this new water supply will be available for use in New York about 1913. The total length of the work, when finally completed about 1930, will be 150 miles, and it will supply about 660,000,000 gallons daily, in addition to the 325,000,000 gallons now available every day from the Croton supply.

The latest proposition in regard to the Catskill Aqueduct comes from the automobile fraternity. They want to use the top of the aqueduct as a basis for an automobile highway, giving a perfect concrete road from Manhattan to the center of the beautiful Catskill region. If so constructed, the roadway is to be 100 feet wide, with concrete walls the entire length, forming a highway superior to any in the world.

The very existence of this new water supply, sufficient for the wants of twelve millions of people, to the expense of which the State and City of New York are positively committed, necessitating the outlay of almost \$162,000,000, is proof most positive of the expectancy of the part of the business men of New York that adequate provision must be made for this increase of population. And this means the doubling and later on the tripling of every building and structure in and about the metropolis of the New World.

The \$101,000,000 Canal Improvement

A YEAR or two ago the State of New York arranged for an improvement of the Erie Canal involving an outlay of over \$100,000,000. The Erie is one of the oldest canals in the country, and connects Lake Erie at a point not far from Buffalo, with the Hudson River, near Albany, being 376 miles long. The existence of this canal has served to keep down freight rates, but it is far too shallow for modern uses. The present enormous outlay is justified in order to permit the passage of barges drawing eight feet. The change will give the canal a transporting capacity sufficient to relieve the adjacent railways of the overplus of slow freight and insure even lower freight rates for the moving

of such cargoes as Portland Cement for all future time. The canal work will extend through a period of years, and will demand large quantities of cement for the retaining walls and locks.

The State of New York could scarce have afforded to reconstruct the canal, if it had been necessary to build of stone, as formerly. The reduction of expense in canal building due to the employment of concrete, is a principal factor in the present canal building boom that is sweeping over the country, and which will undoubtedly result in the creation of thousands of miles of canals before the close of the first half of the twentieth century.



Rapid Transit Subway Station, Twenty-third Street and Fourth Avenue—built entirely of Concrete with a granolithic finish.



New York Subway Construction, showing concrete ceiling and walls. The Subways now building and to be built will require millions of barrels of cement.

Over \$20,000,000 of Dock and Harbor Improvements

THE Bush Terminal Company of South Brooklyn is just completing the construction of a series of eight mammoth docks, each 1,400 feet long and with 40 feet of water alongside, the largest docks in the world. Here they accommodate all sorts of coasters, and transfer freight from the rail to ocean steamships. They have also built about 100 large warehouses, and are building six of the largest concrete factory buildings in the country, on their property near the docks.

This enterprise has stimulated the city, and the Dock and Ferries Department is building what is known as the Chelsea improvement below 23d Street on the North River, where land has been condemned and a new series of large docks is being constructed, to accommodate ocean steamships of great size.

In addition to these, the city has approved plans and will build nine fireproof piers and sheds in South Brooklyn, on the new Bay Ridge Canal. These piers will be 1,200 feet long, and at this writing property is being condemned to make room for them.

These three sets of great docks or piers with their appurtenances will cost \$15,000,000 or more, and involve large outlays for cement construction. But this is not all the money that is being spent in New York Harbor. The United States Government is deepening Ambrose Channel, which is to be gouged out to a depth of 40 feet, at a cost of \$4,000,000, making a shorter and better passage for ocean steamships. Then a 21-foot channel is being dug through the hills north and west of Staten Island, as far as Perth Amboy, to permit vessels of 7,000 tons to use the Jersey side of the harbor. This work will cost \$700,000.

Uncle Sam is also spending a million for the enlargement of Governor's Island, recovering land worth about \$4,000,000 by the outlay, and it is safe to assert that the United States Government can be depended upon to spend many more millions in New York Harbor, as may be necessary to keep pace with the development of the principal inlet of the nation's European commerce.

Twentieth Century Skyscrapers

TEN years ago the 23-story skyscrapers were the wonder of New York, and many thought that development in this direction had reached its limit. There are now in course of erection two steel and concrete structures that will each hold 41 stories for rent and which have towers above carrying them to near a 50-story level. Each of these structures will be between 600 and 700 feet above the sidewalk, and Friede Globe tower at Coney Island is to be 750 feet high.

Thus in one season Greater New York is erecting three buildings, any one of which is far above the top of the Washington Monument, or St. Peter's at Rome, or the Cologne Cathedral, the tallest buildings of Europe. The Singer Building, which is to be ready for occupancy in May, 1908, will tower 612 feet above the sidewalk, and 689 feet from the base of the concrete foundations. Its cubical contents are 7,000,000 feet; its floor area is almost ten acres, and its express elevators will rise to the 30th floor in 30 seconds. There will be 16 high-speed elevators in all, and to guard against fire there is not a single inch of wood except in the flag-staff. It is all concrete and steel, glass and ornamental stone trimmings.

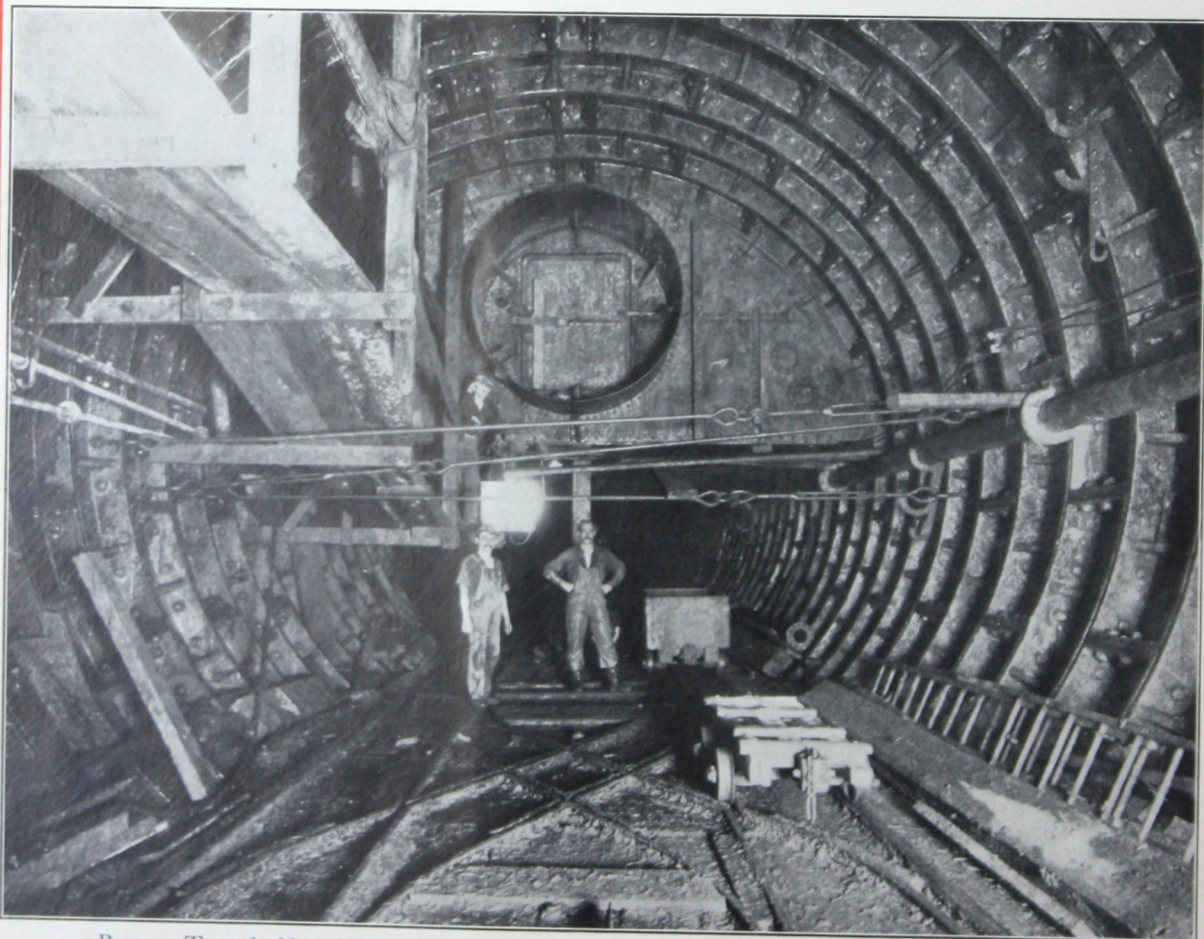
The Metropolitan Life Building, already one of

the largest in the city, will be the tallest when its new tower is completed, being 658 feet from the sidewalk to the base of the flag-staff. The topmost office floor will be 526 feet above the ground, and the foundations extend about 70 feet underground, where the concrete is placed next to the mother rock. Superficially the tower of this kind of office buildings will be of marble, but that is only the facing. The heart is of steel and the flesh is of concrete, like all these big structures, and the marble is only the beautifying skin. The steel framework will weigh about 8,000 tons, the concrete about 28,000 tons, and the marble and other material about 2,000 tons. The occupants will give it a load of about 5,500 tons, so that its total weight in use will be 43,500 tons. As two-thirds of this is concrete, made with Portland Cement, it is obvious that such buildings greatly increase the market for cement. The main building, which covers a block 200×425 feet, is ten stories high while the tower, 75×85 feet, is 46 stories. The floor area is 25 acres. At a height of 325 feet is the largest clock in New York, having four dials, each 25½ feet in diameter.

Though this building mounts 103 feet higher than the Washington Monument, yet it will be still



Dock Work in which Cement is the Principal Material used.



Battery Tunnel, New York to Brooklyn. The walls and floor will be filled in with concrete.

92 feet below the Friede Globe tower at Coney Island. These are only instances of the most spectacular of the new skyscrapers around New York; but they are instances destined to become common in the near future. Other big buildings might be mentioned, as the 32-story City Investing Company Building on Church and Liberty streets, which is as big as the Metropolitan, perhaps greater in floor space, though without the tall tower. It will contain 2,000,000 square feet of concrete blocks and arches. But all of these buildings use so much concrete that figures become meaningless. The point is that the era of 30 to 40-story buildings is at hand, and that each of these will require twice the cement that has gone into the 15 and 20-story skyscrapers of the last decade.

How many big business buildings will be raised

in New York City in the next ten years no one can say with certainty. Theodore Starrett, of the well-known contracting firm, says that 29 large skyscrapers were in progress here on the first of January last. We all know that each year there are more of them, and they grow higher. The total of new large office and factory buildings for 1906 was valued at over \$40,000,000; it may average \$50,000,000 annually for the next decade, or it may rise to \$100,000,000. So keen is the competition for downtown Manhattan realty that Bryan L. Kennelly prophesies that "with the great improvements in the way of tunnels, railroad depots, subway extensions, and bridges it is only a question of time when desirable property in New York below 59th Street will be taken out of the market and ground-rented, as it is in London."

Apartment House Construction

AS stated in an earlier page of this article, New York builders have to accommodate 200,000 of added population each year, and have also to rebuild for 200,000 or 250,000 people who are made homeless by the tearing down of old buildings. There are therefore some 100,000 families that must be provided with new flats, apartments or dwellings every year. If these families pay an average rental of only \$250 a year, this means that the new residences provided for them are worth \$2,500 per family, or \$250,000,000 worth of flat-houses, apartment houses and dwellings. Of this total about \$150,000,000 is land value and \$100,000,000 buildings.

These estimates agree with the facts as gleaned in other ways. For instance, the **New York American** figured the increase in real estate values

in New York during the past ten years at \$7,000,000,000, or \$700,000,000 a year; certainly one-seventh of this was for concrete dwellings. The building permits granted in Manhattan, Brooklyn, and the Bronx for the two years (1905 and 1906) totaled over \$430,000,000. It is not too much to estimate that fully half of this was for dwellings, and that more than half the dwellings will be of concrete construction. Therefore at the least possible calculation there will be \$600,000,000 spent for concrete dwellings in New York within the next ten years, measuring at the present rate of growth. But as the growth is progressive, ever increasing in ratio, doubtless \$750,000,000 is nearer the truth, especially as the proportion of concrete buildings to brick, stone and wood buildings is constantly gaining.

The Jersey Suburbs Development

NORTHERN JERSEY for a distance of 30 miles from New York City Hall is as truly a part of the metropolis as are the distant boroughs of Queens and Richmond. That territory has a population of 750,000, and includes the large cities of Newark, Hoboken and Jersey City, besides the Oranges, Bayonne, and a score or two of other prosperous municipalities, all more or less dependent on New York, and for business purposes precisely the same as if a part of New York. The improvement works on these have not been reckoned in most of the foregoing estimates, and should be added to gain a correct idea of the total. As the Jersey suburbs have over one-sixth the population of Greater New York, and as communication is

being vastly improved by tunnels and bridges, it is fair to assume that the building improvements there will be a sixth of the city's total of \$215,000,000 a year, that is \$35,000,000 annually. If this be correct, there will be \$350,000,000 spent for building and engineering works in Jersey in the next decade.

Putting all these things together, it is demonstrated that the public and private improvements in and around Greater New York during the next ten years will be much nearer two billions than one billion of dollars. And into all these works Portland Cement must go. Is it not evident that no other common material is going to be in such tremendous demand?



Concrete Factory of Keuffel & Esser at Hoboken, N. J. Built by Turner Construction Co.—6,000 barrels of cement used in construction.



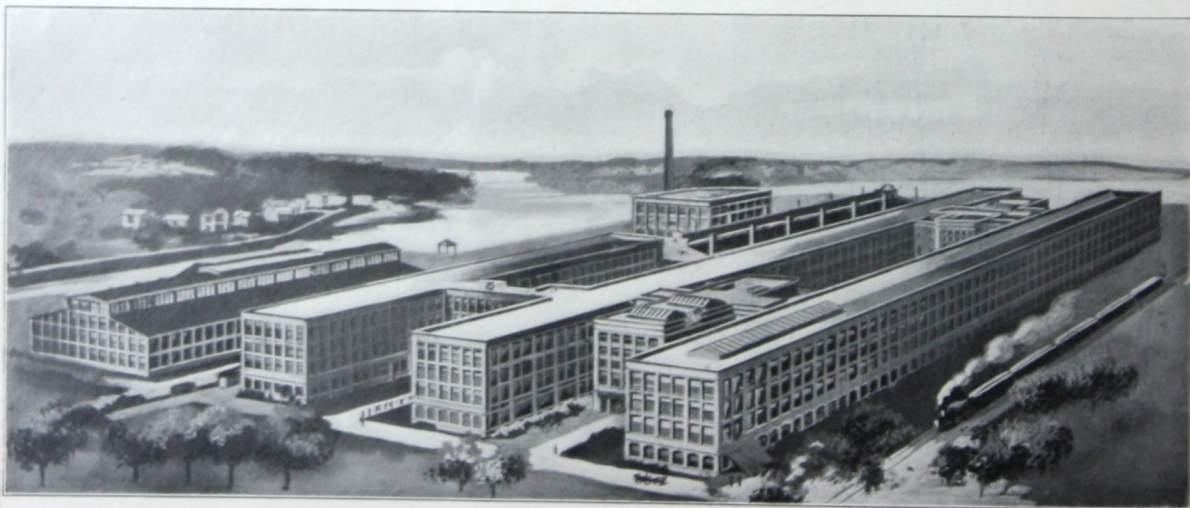
Bush Terminal Factory in Brooklyn. One of six great concrete structures they will build—82,000 barrels of cement used in its construction.



The Gair Concrete Factory Building, Brooklyn. A type of modern reinforced concrete factory construction—13,000 barrels of cement used in its construction.



Concrete Storage Building, Standard Oil Company, Bayonne, N. J.—6,500 barrels of cement used in construction. These four factories built by the Turner Construction Company.



United Shoe Machine Company's Plant, Beverly, Mass. Reinforced concrete, 500,000 square feet of floor space. Reinforced Concrete Buildings.

The Seaboard Market for Cement

NEXT to New York City in importance as a market for Portland Cement are the seaboard cities of the United States, and beyond these the ports of Canada, the West Indies, and South America. The large cities of the East are all progressive—Boston, Philadelphia, Baltimore, Washington—all centers of constructive industry. Each of these cities has its public works; all of them are erecting manufacturing and business buildings, as well as dwellings of concrete. The measure of the prosperity of a modern city is the quantity of Portland Cement that it requires for concrete construction.

Seaboard cities are specially progressive, and since they build piers and breakwaters, and other works not needed by inland towns, make especially large demands for Portland Cement. The taxable property growth of the leading Eastern seaboard cities is an excellent guide in estimating their demand for building material. Here are the figures:

	Assessed Valuation.	
	1901.	1906.
Portland.....	\$43,000,000	\$51,000,000
Boston.....	902,000,000	1,045,000,000
Fall River.....	71,000,000	83,000,000
Philadelphia.....	894,000,000	1,250,000,000
Baltimore.....	402,000,000	596,000,000
Washington.....	192,000,000	268,000,000
	\$2,504,000,000	\$3,293,000,000

These six cities show a gain of nearly \$700,000,000 in five years. Probably \$400,000,000 of this gain was in buildings, and more of these employing concrete. On this assumption the six cities with a population three-fourths that of New York are spending for new buildings at the rate of eight hundred million dollars a decade. The smaller cities and towns also are reconstructing on a scale proportioned to their population and business.

Everywhere it is the same thing: as the wood and the brick buildings decay or become inadequate to requirements they are being displaced by concrete construction. This is now the universal

material for foundations, pavements, gutter-stones, etc. Since the Baltimore fire it is the only material considered for surrounding steel work, hence any steel building calls for three times as much concrete as steel. It is used also in the most humble and economical of structures, because it is cheap.

Portland cement has become the chief material of the builder because it is both better and cheaper than the wood, brick and stone that it is replacing.

It is cheaper than wood, twenty times as durable, and it is fireproof.

It is cheaper than brick, which last year sold in New York at \$13 a thousand, especially as a much less weight of concrete has the same strength, and weathers better than brick.

The public wants cement faster than it can be produced, and is bidding up the price. **The Contractor**, in its issue of May 15, says that the price of cement has increased enormously, and that the Government is asking for hundreds of thousands of barrels, being "compelled to accept bids at prices nearly double those paid two years ago. Reinforced concrete in 1905 averaged \$8.50 per cubic yard, while the responsible bids this year (1907) are from \$16 to \$21."

It is cheaper and better than quarried stone, as it is easily made of uniform strength and quality. It can be colored to imitate any sort of stone, and it avoids the expense and nuisance of stone dressing around a new building.

This is why concrete made of Portland Cement is the chief material called for in billions of dollars' worth of construction described in this monograph. Without it half the works planned could not be, for they would cost too much or be too unsafe in other material.

No wonder that sixty-two comprehensive articles on cement and concrete appeared in one month's issue of the trade journals of the United States, as listed in the **Cement Age** for April, 1907. It is the material of to-day and of the future. The Western World has commenced to rebuild in concrete, and the work will go on until wooden and brick edifices are as scarce in cities as are bark shacks and Esquimaux igloos.



St. James' Church, Brooklyn, N. Y. Concrete construction.



Concrete Building of the Eastern States Refrigerating Co., Hoboken, N. J.



Public School, Bryant and Tremont Streets.

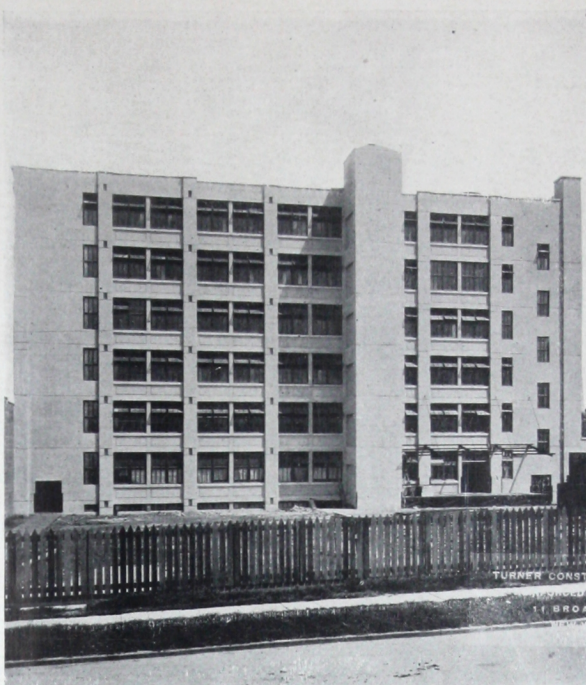


Public School No. 42, Bronx.

Buildings of Reinforced Concrete In and Around Greater New York.



Larkin's Building, 4 White Street, New York.



Concrete Factory Building, Brooklyn.

Buildings of Reinforced Concrete In and Around Greater New York.



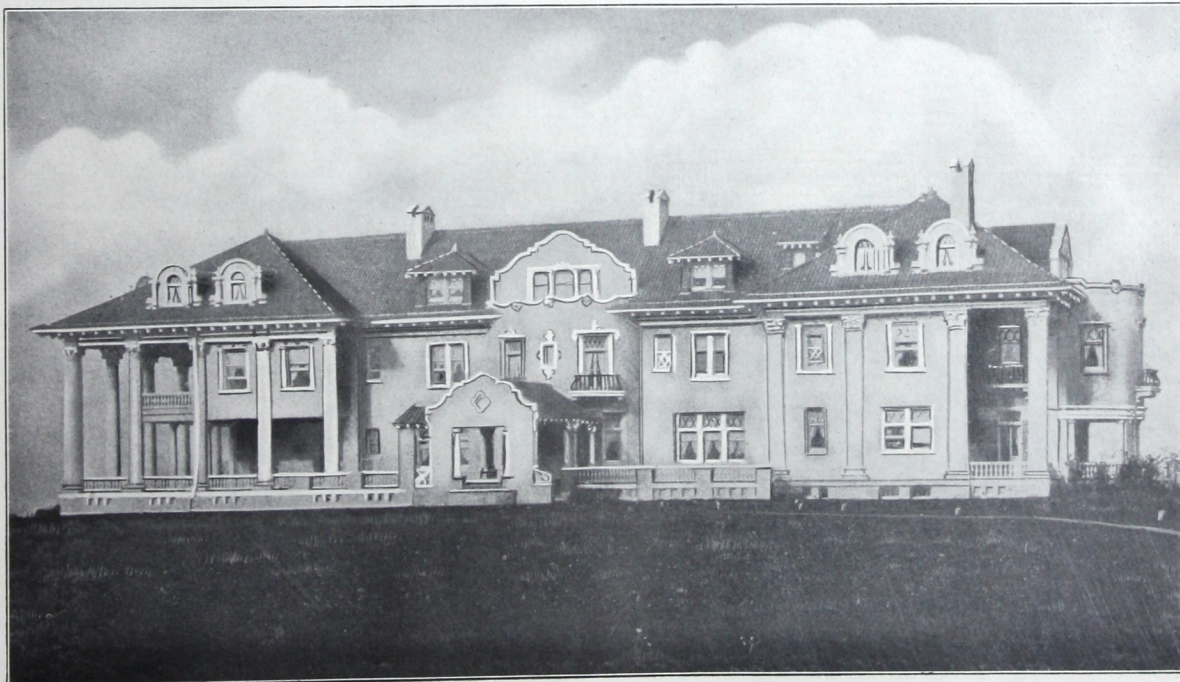
Hotel Blenheim, Atlantic City, N. J.—One of the largest hotel buildings in the world, built entirely of reinforced concrete.



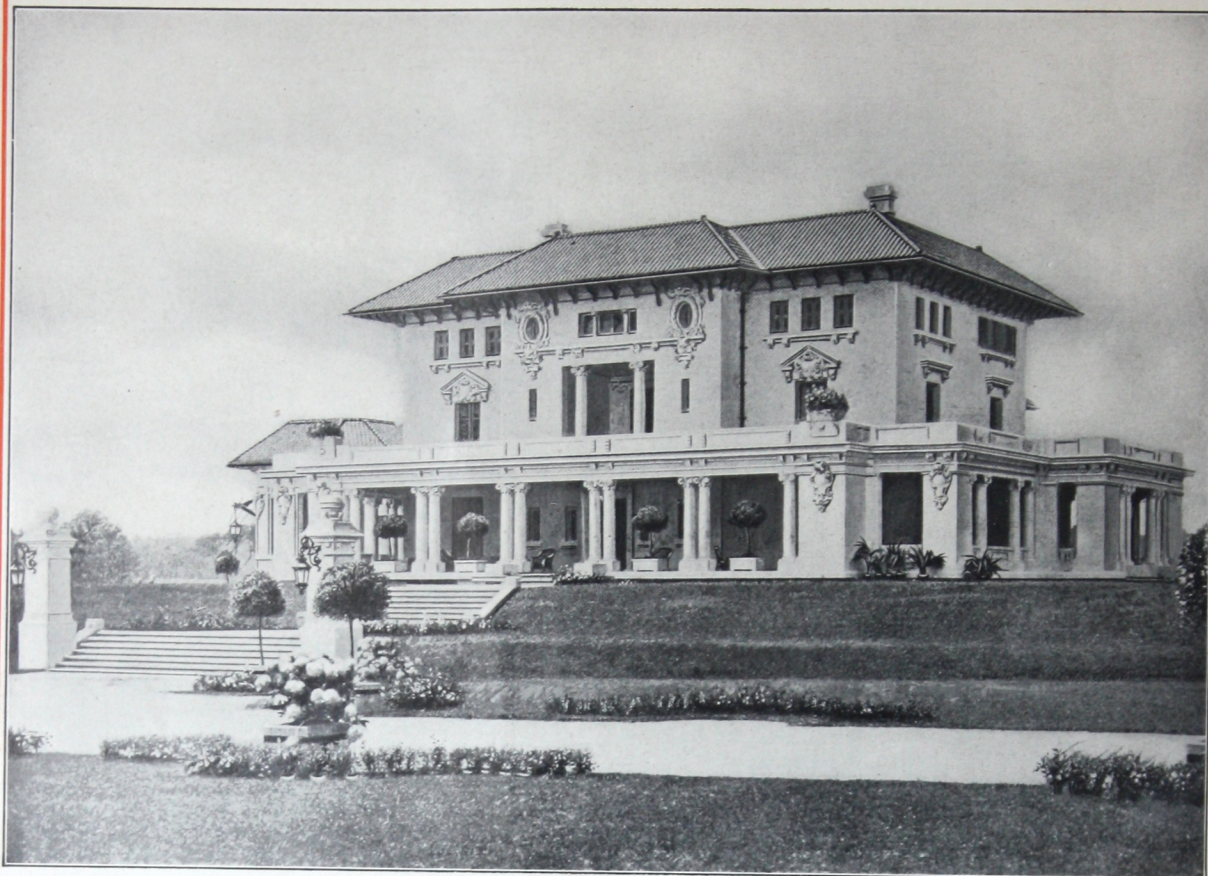
The "Monolith" Building, Broadway and 34th Street, New York.—Built entirely of Reinforced Concrete. A striking example of the large buildings now being constructed of this material in the centre of the business section of New York.



Residence of Reinforced Concrete.



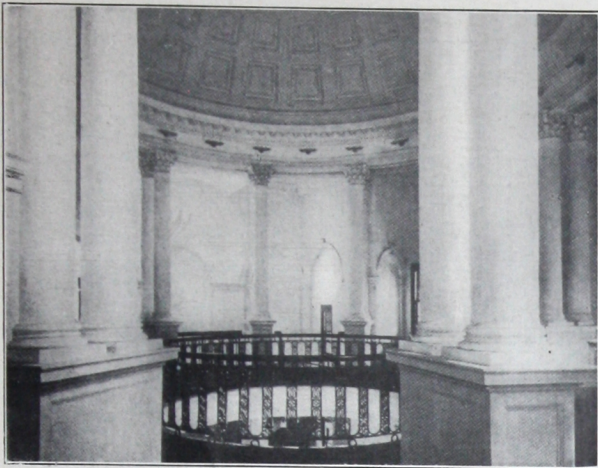
Concrete and Brick Residence.



Residence at Elberon, N. J.—Reinforced Concrete Stucco Construction.



Reinforced Concrete Stucco Residence, West End, N. J.



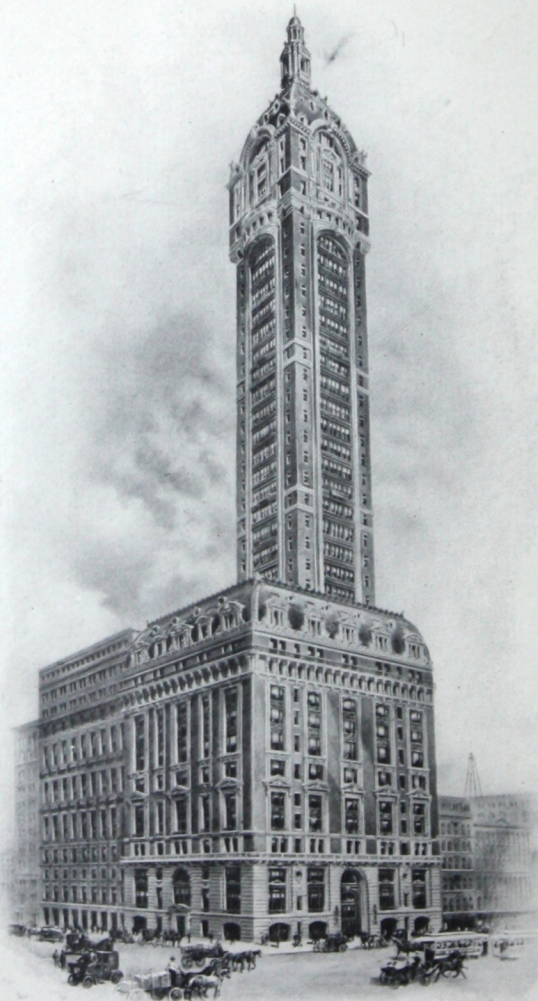
Nassau County Court House, Mineola, L. I.—Constructed entirely of Reinforced Concrete.



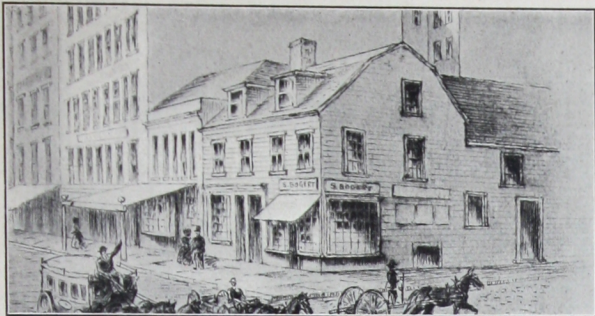
Flat-Iron Building.



Five Skyscrapers in the Wall Street District.



The Singer Building, highest building in the world.
Skyscraper office buildings in New York City, which are made possible by the use of concrete made of Portland Cement for foundations.



Southwest Corner Broadway and Cortlandt Street, 1846. Southwest Corner Broadway and Cortlandt Street, 1906.



The City Investing Building, Southwest Corner Broadway and Cortlandt Street, 1908.

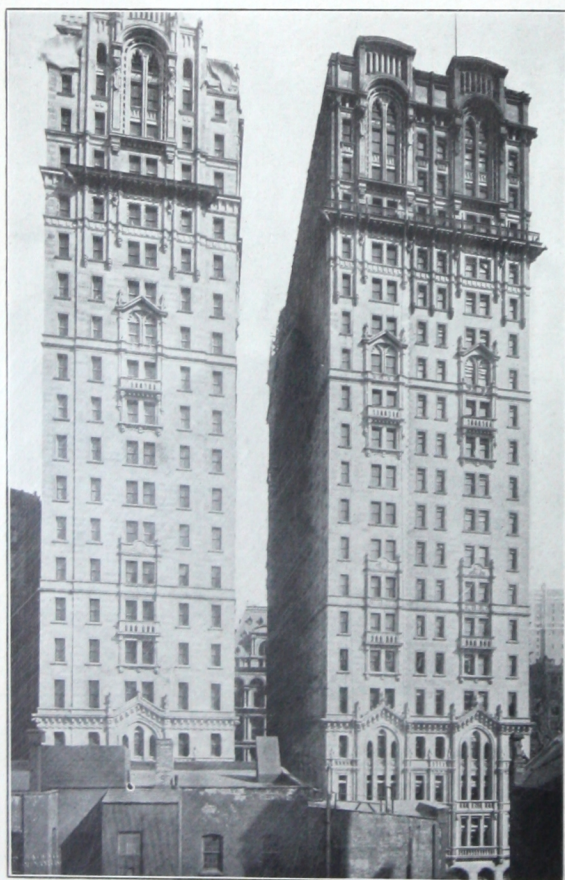
Illustration of the building development in New York City. Such buildings as the City Investing Building, now being erected at Broadway and Cortlandt Street, are only made possible by the use of concrete foundation made from Portland Cement.



U. S. Express Building.



West Street Building.



Trinity and City Realty Buildings.



Whitehall Building.

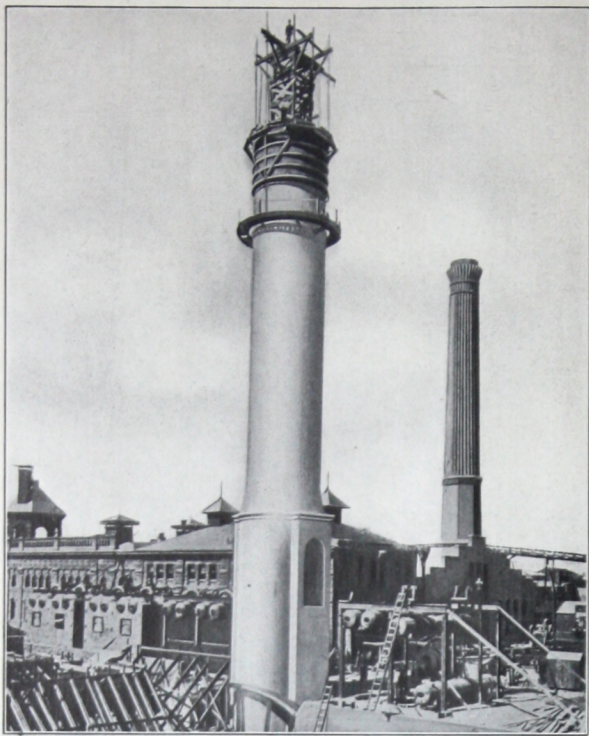
Skyscraper office buildings in New York City, which are made possible by the use of concrete made of Portland Cement for foundations.



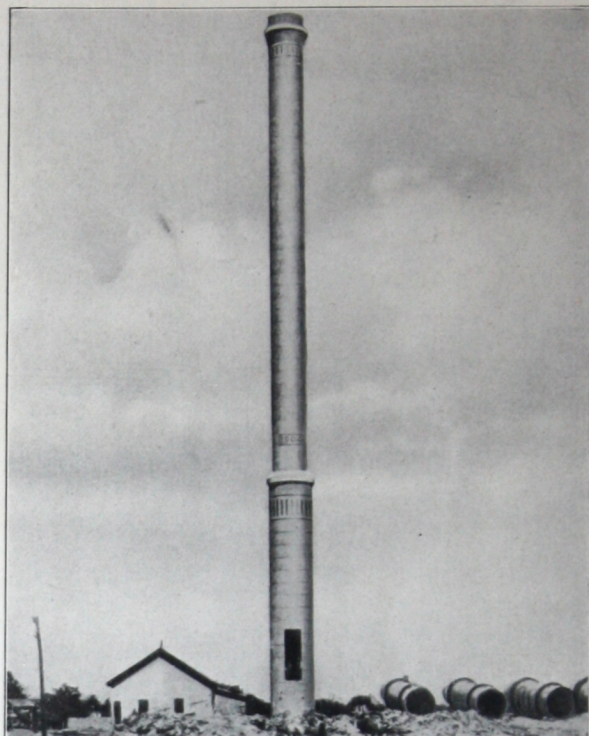
Equitable Building, the largest building
in the world in 1887.



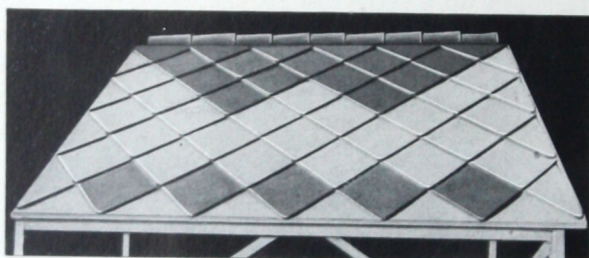
An illustration of the building development in New York City. In 1887 the Equitable Building was the largest office building in the world. Below it is given the new Church Street Terminal Building now under construction, and will be completed in 1909.



Concrete Chimney in Course of Construction.



Completed Concrete Chimney—182 feet high, 8 feet inside diameter.



Cement Roofing Tile. Moulded in steel dies. Cannot warp, split, or crumble.

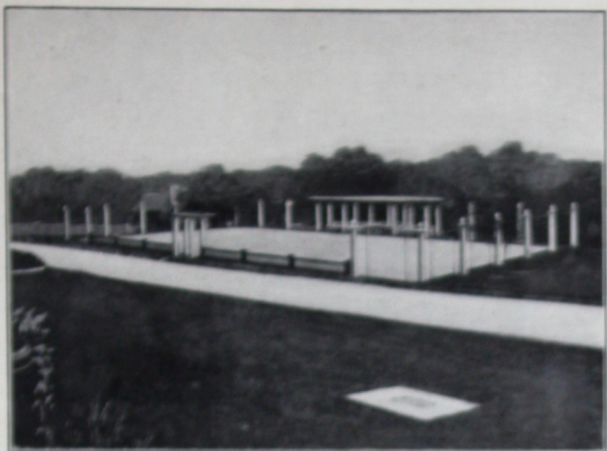


Type of Modern Railroad Bridge, Concrete Construction.



Concrete Bridge.

Miscellaneous Uses for Portland Cement.



Portland Cement Tennis Court.—Court, Pergola, and Columns constructed entirely of Portland Cement Concrete.



Example of Portland Cement Ornamental Pedestal.



Concrete Base for Telegraph Poles.



Concrete Sea Wall, Galveston, Texas.



Portland Cement Blocks with Hand-tooled Edges.



Portland Cement Pavement.

Miscellaneous Uses for Portland Cement.

